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BULLETIN

OF THE NEW YORK ACADEMY OF MEDICINE

Original Articles by

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1. Scherbel, A. L.; Schuchter, S. L., and Harrison, J. W.: Cleveland Clin. Quart. 24:98, April, 1957.
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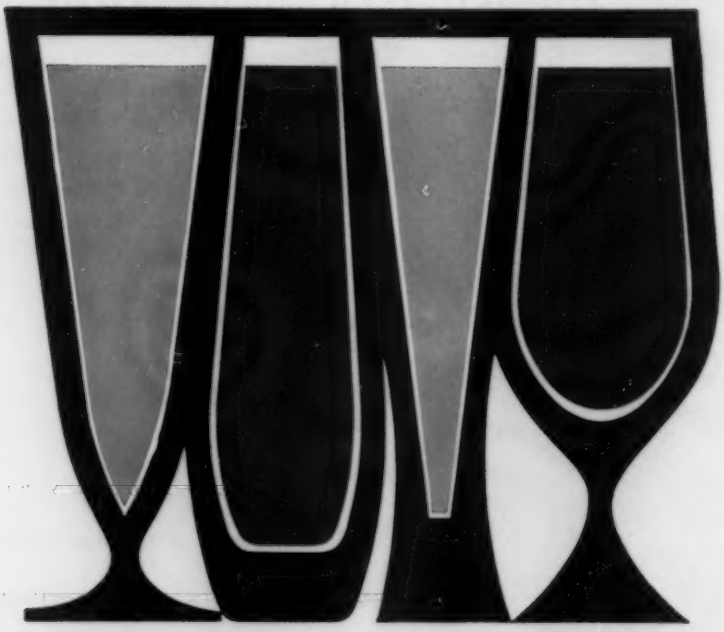

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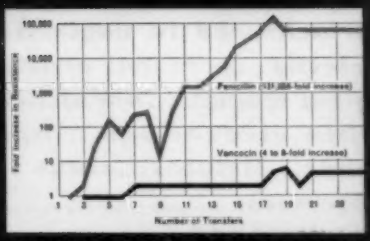

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ROBERT L. CRAIG, *Editor*

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BULLETIN OF
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VOL. 37, NO. 5 MAY 1961

CLINICAL IMPLICATIONS OF CYANOSIS*

HARRY W. FRITTS, JR.

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SEVERAL years ago a farmer, age 51, entered Bellevue Hospital in a state of partial confusion. He was weak and listless, and his thin, poorly-nourished body suggested that he was both seriously and chronically ill. His illness had started ten years earlier when he began to be troubled by breathlessness. This symptom was always related to effort; it did not occur at night; and for a long while it was not associated with other stigmata of heart and lung disease. Then one year before admission his ankles became swollen. Digitalis reduced the edema, but the fluid reaccumulated over a period of several months. A few days before admission the patient became confused and disoriented. When these symptoms failed to respond to bed rest, the man was brought to Bellevue.

The House Officer first ruled out the possibility of digitalis intoxication, then he treated the patient's congestive failure vigorously. By the end of a week this regimen had improved the man considerably; his dyspnea had subsided and his confusion had disappeared. But a puzzling

* Presented at the Fourth Annual Postgraduate Week, *Frontiers in Medicine and Surgery*, of The New York Academy of Medicine, October 25, 1960.

complication persisted: the skin and mucous membranes of the patient remained markedly cyanosed. The puzzle did not arise from a lack of causes to explain the cyanosis; it stemmed, rather, from the fact that none of the possibilities seemed adequate to account for the intense discoloration of the skin. The problem was further complicated by two points in the history. The first was that the man was an alcoholic. The second was that he had worked for many years in silos where, on several occasions, he had developed acute dyspnea while breathing the irritating fumes which rose from the mouldering hay.

Because of the unusual nature of his illness, the patient attracted much attention. He enjoyed the individual opinions of a score of doctors and the collective opinions of three conferences. Yet, when he suddenly became worse six months later, he died without the precise diagnosis having been made. At Bellevue we regard the man as one of the most curious examples of cyanosis we have encountered, and in my own mind the name of this patient and the word "cyanosis" are rather firmly linked.

Thus, when Dr. McGuinness extended his kind invitation to speak here this evening, I immediately recalled the story of this man. And I thought it might be worthwhile to use that story as a background for this presentation, by tracing the attempts which were made to unravel the patient's disease. To this end, my remarks about cyanosis will be divided into three parts: general considerations, specific causes, and —finally—frontiers, since frontiers are the themes of the presentations this week.

General Considerations

The most useful first step is to agree on a definition of "cyanosis". The word stems from the Greek and simply means "dark blue". Although more elaborate definitions have been suggested, none has been completely satisfactory. Hence, for the purposes of this discussion, "cyanosis" will be used to denote a blueness of either the mucous membranes or the skin.

The second point is that cyanosis cannot be measured. It is a subjective diagnosis and, as such, frequently controversial. Those of you who are interested in observer variability will enjoy a paper published in 1947 by Dr. Julius Comroe and Dr. Stella Botelho.[1] These investigators induced different degrees of cyanosis by administering different

hypoxic mixtures to normal subjects, and they then had platoons of physicians express opinions as to whether the subjects looked blue. The results must have disillusioned practicing physicians, because the data revealed two unexpected facts. The first was that the majority of observers were unable to detect cyanosis when the arterial saturation had fallen to 80 per cent. The second was that a quarter of the observers still could not perceive blueness when the arterial saturation lay between 71 and 75 per cent. These observations led Comroe and Botelho to conclude that the appearance of cyanosis depends on the doctor as well as on the patient, a point which sometimes goes unrecognized.

The third consideration concerns the time-course of cyanosis. In many patients the degree of blueness varies, a circumstance which further complicates the problem of deciding whether cyanosis exists.

The fourth point is of particular importance; it is that multiple factors contribute to the color of the skin. Lundsgaard,[2, 3] and later Lundsgaard and Van Slyke,[4] analyzed the various factors and decided that the thickness of the epidermis, the density of the capillaries, and the dilatation of the vessels were important determinants. They also believed that the pre-eminent factor was the concentration of reduced hemoglobin circulating in the cutaneous capillaries. Specifically, they thought that cyanosis would appear in a patient, who was otherwise normal, when the reduced hemoglobin reached a level of about 5 grams per 100 ml. of capillary blood. Since this level is related to both the arterial and venous saturations, it follows that blueness may be expected in any situation where the oxygen content of either the arterial or venous blood is lowered. It also follows that polycythemia—which increases the concentration of hemoglobin—will increase the likelihood of the appearance of cyanosis, while anemia will tend to reduce the chance of its occurrence. Although in a small series Geraci and Wood[5] were not able to demonstrate that cyanosis appeared in polycythemic patients at higher arterial saturations than in normal subjects, the approximate relation between these two variables is still worth repeating. Whether or not the appearance of cyanosis depends directly on the number of red cells, the concentration of the cells unquestionably influences the color of the skin. The same is true of the concentration of any abnormal pigment in the blood, the skin, or the subcutaneous tissues. In short, blueness depends on multiple factors, not a single one.

TABLE I—CONDITIONS CAPABLE OF PRODUCING EITHER GENERALIZED OR LOCALIZED CYANOSIS IN PATIENTS WHO HAVE NORMAL ARTERIAL SATURATIONS

1. Congestive heart failure.
2. Venous obstruction.
3. Shock.
4. Local vasomotor disturbances: acrocyanosis, Raynaud's disease.
5. Abnormal hemoglobin: methemoglobin, sulphemoglobin.
6. Abnormal pigments: silver, Evans blue dye.

How, then, do these generalizations bear on the patient whom we saw at Bellevue? He was definitely blue; the intensity of his blueness varied little with time; nothing in his story implicated a single factor as the cause of his trouble; and he was neither polycythemic nor anemic. Hence, we all agreed that the man had a serious condition, but at the outset we had little idea about its identity.

SPECIFIC CAUSES

We next turned to considering the causes of the patient's cyanosis. Several classifications of causes have been suggested, most of the schemes having been based on defined terms.[3, 6] For example, all of you have heard of "central cyanosis", "peripheral cyanosis", "hypoxic hypoxia", "anemic hypoxia", and "stagnant hypoxia". For the most part, these terms were coined more than a decade ago, before the array of tests now available for studying cyanosis had been devised. The terms are still useful, but in practice a complex classification can be replaced by three questions, which the physician can ask. The questions are:

1. Is the patient's arterial saturation normal?
2. If the saturation is low, is it because the alveoli do not oxygenate the pulmonary capillary blood properly?
3. If the saturation is low and the alveoli function properly, is the cyanosis due to the presence of channels which by-pass the alveoli and carry venous blood into the systemic circulation?

Answering these questions will lead to a diagnosis in the majority of persons who are blue.

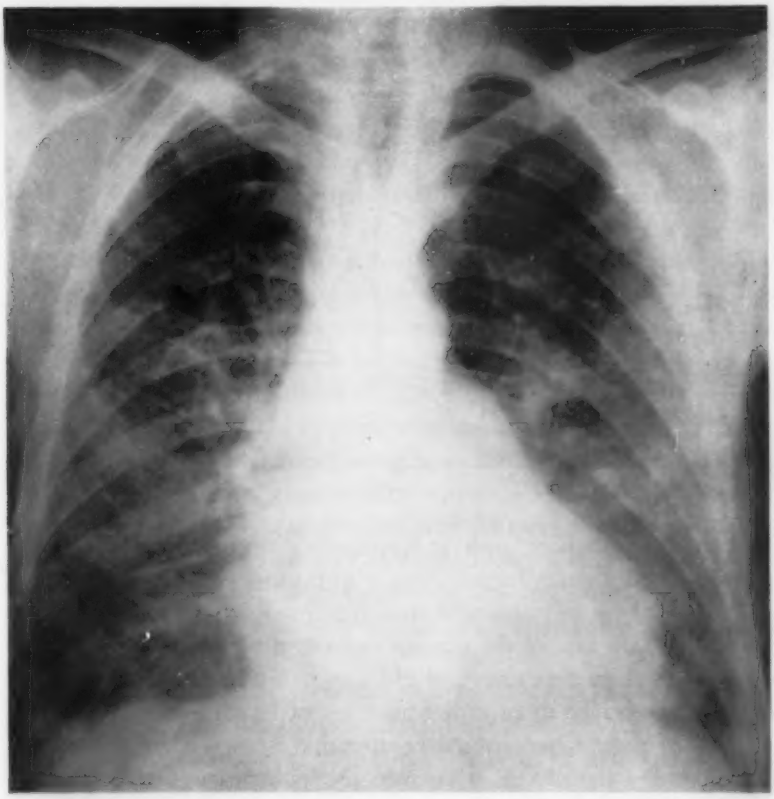

Figure 1. Chest x-ray of the patient.

The arterial saturation of our patient was abnormal. Measured on several different occasions, the level varied between 60 and 81 per cent. This, therefore, eliminated the conditions listed in Table I as the sole sources of the patient's color. The listed disorders represent both common and uncommon causes of cyanosis, and they embrace several mechanisms whereby blueness is produced. For example, a patient with either congestive heart failure or venous obstruction can have a normal arterial saturation and yet be cyanotic because the venous saturation is so low. The same is true of any patient who has a reduced cardiac output: the classic example is a patient in shock. Similarly, regional

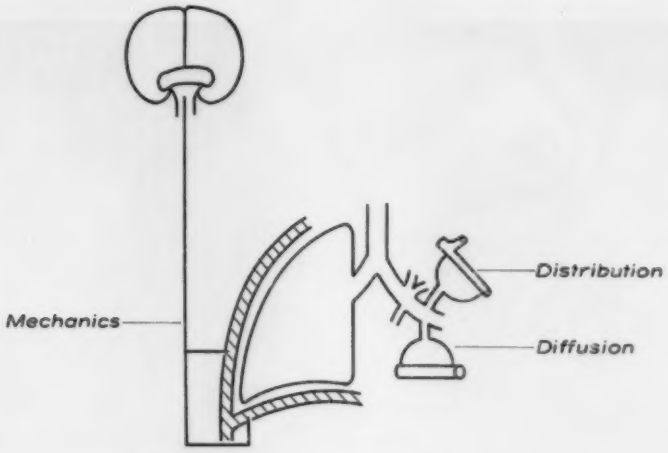

Figure 2. Parts of the respiratory process.

vasomotor disturbances, such as Raynaud's disease, can produce local cyanosis of an intense degree. Also, a man can have a normal arterial saturation and yet be cyanotic if abnormal hemoglobin or dyes circulate in his blood. Because of the current interest in blood volume measurements, the sudden appearance of cyanosis in a hospitalized patient can sometimes be traced to an earlier injection of Evans blue dye.

But our patient had arterial unsaturation, so we asked the second question, "Do the alveoli oxygenate the pulmonary capillary blood properly?" Evidence that this question might have an important bearing on the patient's illness was provided by the physical examination. The chest was hyperresonant and crackling rales were audible at the bases of the lungs. Further, the chest x-ray (Figure 1) was definitely abnormal: the alveolar areas were mottled and the hilar shadows were accentuated. Under fluoroscopy the motion of the lungs seemed adequate, the chest wall having a normal excursion and the leaves of the diaphragm moving freely despite some blunting of the right costophrenic angle.

In view of the suspicious appearance of the lung fields, we began assessing the effectiveness with which the alveoli supplied oxygen to the pulmonary capillary blood.[7] The structures important to this process are sketched in Figure 2. As shown in the drawing, the medulla, the

nerves and the respiratory muscles must be capable of supplying the lungs with about five liters of air per minute, and the volume of the lungs must be adequate to accept this supply of air. Further, the air must be distributed to alveoli contacting actively perfused capillaries. Finally, the diffusion of oxygen from alveolar air to capillary blood must proceed without impediment. These related processes are conventionally grouped under three headings: mechanics, distribution and diffusion.

In our patient the mechanics of breathing, assessed by the usual indices, seemed surprisingly good. The maximal breathing capacity was normal; the vital capacity was 80 per cent of the predicted value; the total lung capacity was only slightly diminished; and the residual volume was not enlarged. This combination argued against the presence of emphysema, one of the most popular initial diagnoses.

The distribution of blood and gas appeared to be less satisfactory. In assessing this part of the respiratory process we found that the dead space of the patient was much increased. In fact, 70 per cent of each inhaled breath did not take part in the exchange of oxygen and carbon dioxide. This indicated a gross disturbance of distribution, since in normal man the dead space constitutes only about 20 per cent of the volume of each breath.

Further, the diffusing capacity of the lungs seemed to be subnormal. Although technical difficulties precluded the possibility of calculating a specific figure, there was evidence that some sort of block impeded the exchange of gas. But what could have produced the barrier? Nothing in the history or physical examination supported a diagnosis of sarcoid, beryllosis, silicosis, disseminated carcinoma or miliary tuberculosis, the usual causes of diffusion block. It is true that the man had worked in silos and was, therefore, qualified to have either "silo-filler's disease" or "farmer's lung." Again we could not establish the presence of either condition, although these were two of the diagnoses put forth on the medical ward.

Hence our answer to the second question was partly precise and partly equivocal. On the one hand, the mechanics of breathing were so nearly normal that emphysema seemed unlikely. On the other, the defective distribution and diffusion of gases made a diffusion barrier seem the best possibility, although we had no clue regarding the underlying etiology.

TABLE II—SOURCES OF VENOUS MIXTURE

1. Congenital defects of the heart and great vessels.
2. Thebesian veins.
3. Anterior cardiac veins.
4. Bronchial-pulmonary vascular anastomoses.
5. Pulmonary arteriovenous shunts.
6. Portal-mediastinal-pulmonary vascular connections.

We turned, therefore, to the third question: "Did venous blood reach the systemic circulation through channels bypassing alveoli?" Such blood, called "venous admixture", travels through extra-alveolar pathways and thus does not participate in the exchange of gas. The pathways which can contribute to the total admixture are listed in Table II.

The first step toward proving the existence of one of the pathways is to measure the arterial oxygen content while the patient breathes oxygen. At high tensions of this gas, the blood hemoglobin is not only saturated but about 2 ml. of oxygen exist in physical solution in each 100 ml. of blood. Further, breathing oxygen minimizes the effects of malfunctioning alveoli, so that any deficit in the arterial oxygen content is chiefly due to venous admixture alone. But pitfalls may obscure the results of this test for the unwary physician. First, the oft-quoted rule that the disappearance of cyanosis on breathing oxygen rules out the diagnosis of venous admixture, is an unreliable criterion. Second, the use of an oximeter to gauge the disappearance of cyanosis during oxygen breathing may also give a misleading result. This is owing to the fact that both approaches fail to take into account the oxygen carried by the blood in physical solution; this dissolved oxygen is capable of masking a defect in the function of the alveoli.

Since our patient did not achieve full arterial saturation when he breathed oxygen, we wondered whether one of the listed pathways might be contributing to the color of the skin. The grossly enlarged heart led some physicians to suggest that the patient had a congenital cardiac defect, and, in the remote hope that the man might have a remediable lesion, Dr. Ludwig Eichna, Dr. Bertha Rader and other members of their staff performed a cardiac catheterization. Dr. Eichna

TABLE III

	Right Atrium	*Right Ventricle*	*Pulmonary Artery*	*Brachial Artery*
O_2 Saturation (%)	33	33	33	69
Presssure (mm.Hg.)	7	102/5	104/36	106/62

and Dr. Rader have kindly allowed me to publish the results shown in Table III. In patients such as this man, one searches for abnormal openings between the right and left chambers by following the course of the catheter under the fluoroscope and by examining the oxygen content of samples of blood withdrawn from various sites. While no openings were identified and no discrepancies in saturation were demonstrated, the pressure measurements were peculiar: the pulmonary and brachial arterial systolic pressures were almost identical, as can be seen in Table III. This raised a faint suspicion that even though there were no murmurs, the man might have a ventricular septal defect.

Supplementary tests, such as angiography, might have provided additional information. Another test—one which has become popular since this man was studied—entails using dye curves to detect septal defects. This technique, developed mainly through the efforts of Dr. Earl Wood, Dr. H. J. C. Swan and other members of the Staff of the Mayo Clinic,[8-10] is based on the principle depicted schematically in Figure 3. Here, a ventricular septal defect carries venous blood into the systemic circulation, and the arterial dilution curve has two peaks, rather than one.

But there was little evidence to support the diagnosis of a septal defect, so we considered the possibility that the extracardiac pathways listed in Table III were carrying venous blood around the lungs. Because of the limitations in methodology, the contributions of only a few of these channels can be individually identified. For instance, no method is available for measuring the blood perfusing anterior cardiac and Thebesian veins; this flow, however, is thought to be small. Nor can we measure the flow through bronchial-pulmonary connections which carry unsaturated blood into the pulmonary veins.

Recently, a technique has been developed to assess pulmonary arteriovenous shunt flow by using intravenous injections of solutions

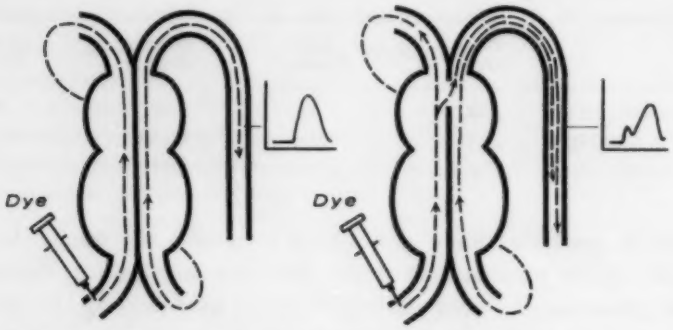

Figure 3. Technique of using dye curves to detect septal defects. Dye is injected into the venous circulation. Normal patient on the left gives an arterial dilution curve with a single peak; patient on the right has a septal defect with a right-to-left shunt and, as a consequence, his curve has two peaks.

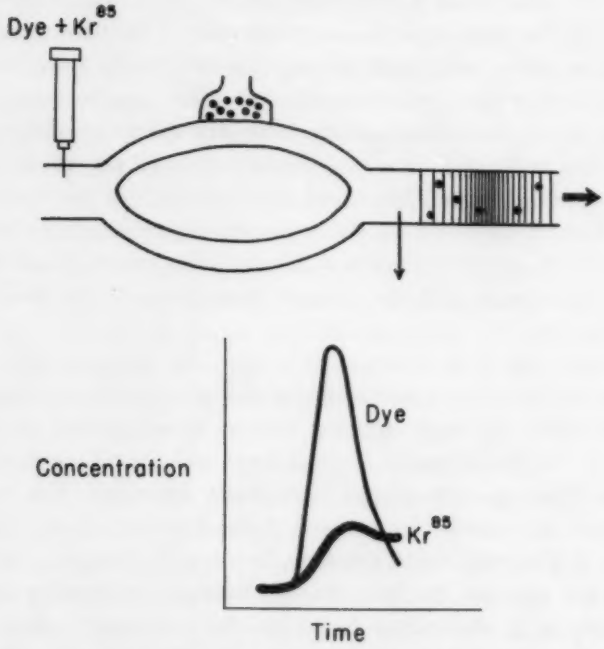

Figure 4. Use of intravenous injections of dye and Kr^{85} to detect pulmonary arteriovenous shunts.

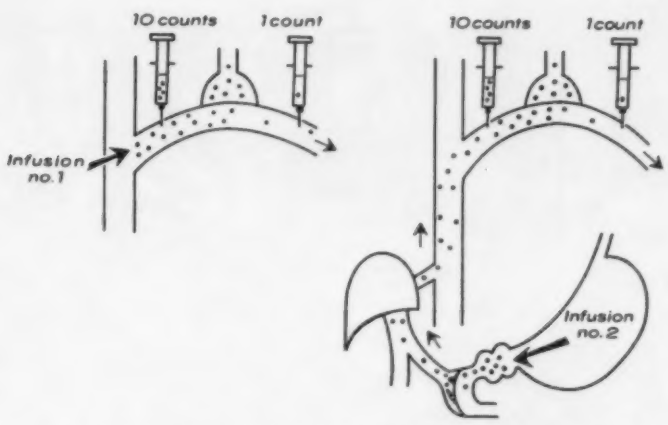

Figure 5. Infusion of Kr^{85} into the right atrium (left) and stomach (right) of a patient free of hepatic disease. For explanation, see text.

containing the inert gaseous isotope Kr^{85} dissolved in Evans blue dye.[11] The principle of the method is shown schematically in Figure 4. Blood traversing shunts retains its Kr^{85}, while blood perfusing capillaries loses its Kr^{85} into the alveoli. By comparing the amount of Kr^{85} to the amount of blue dye appearing in the brachial artery, the fraction of the pulmonary arterial blood flow perfusing shunts can be estimated. But since this technique was not available when the patient was studied, the value it might have yielded is not known.

The last pathway, seen in patients with Laennec's cirrhosis, has recently attracted much attention and could have conceivably contributed to the cyanosis in this man. McIndoe,[12] Schoenmackers and Vieten,[13] and Calabresi and Abelmann[14] have all adduced postmortem evidence for the existence of vascular connections between the portal circulation and the pulmonary veins. To test whether blood traverses this pathway in living patients, the method sketched in Figures 5 and 6 has been utilized.[11] Kr^{85} is first infused into the right atrium while samples of mixed venous and arterial blood are drawn. Later, Kr^{85} is introduced into the portal circulation by injecting a solution into the stomach through a Levine tube, and again arterial and venous samples are collected. In subjects free of liver disease (Figure 5), the lungs clear about 90 per cent of the Kr^{85} from the blood stream regardless of

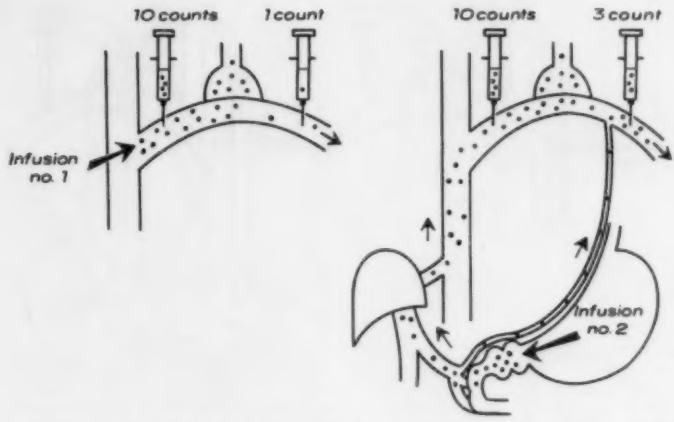

Figure 6. Infusion of Kr^{85} into the right atrium (left) and stomach (right) of a patient with cirrhosis. Postulated portal-pulmonary connections are sketched. For explanation, see text.

the route of the infusion, so that for every ten counts appearing in the mixed venous sample, only one appears in the arterial blood. But patients with cirrhosis behave differently. Whereas the ratio of ten to one obtains when the isotope is infused into the right atrium, the ratio falls to about ten to three when Kr^{85} is introduced into the stomach (Figure 6). While these results have suggested the presence of the portal-pulmonary connections sketched in the drawing, they have not revealed the magnitude of the flow which these connections carry. Even if the method had been available during the life of our patient, it would doubtless have shed little light on our problem, since it seems improbable that an arterial saturation of 60 per cent could be caused by portal-pulmonary connections alone.

This, then, was the story. The man did not have emphysema; probably he had a diffusion block; possibly he had a congenital heart defect; maybe he had some other vascular pathway which carried venous blood around the alveoli. In short, we didn't know.

Our questions were answered by the autopsy, which provided sections of lung tissue such as that shown in Figure 7. The section was stained by the Smith-Dietrich technique, and it revealed that the cells were loaded with fat which had a high phospholipid content. Hence,

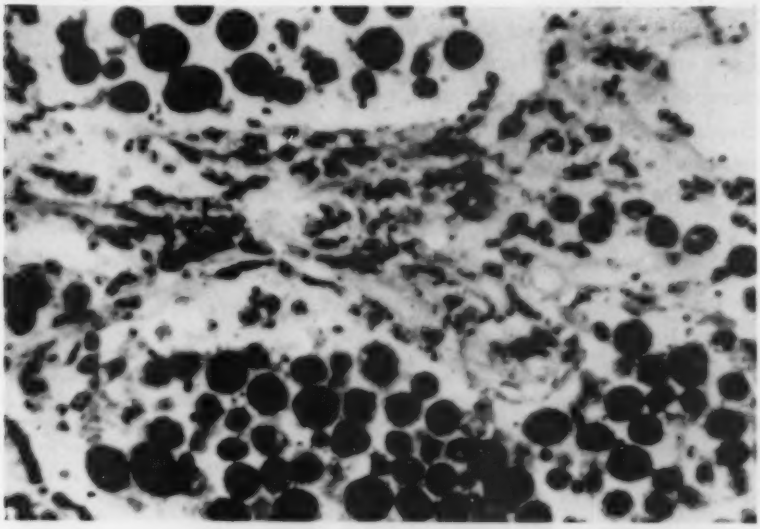

Figure 7. Section of lung tissue stained by Smith-Dietrich technique. Black globules are fat (Courtesy Dr. Marvin Kuschner).

the man had a lipoidosis of the Niemann-Pick variety, an unusual occurrence in a person his age. Abnormal tissue almost completely replaced the alveoli, and while the exact state of the lung physiology cannot be reconstructed, it seems likely that the man's primary difficulty was a diffusion defect. In addition, the gross disruption of the pulmonary architecture undoubtedly disturbed the distribution of blood and gases and may even have caused some of the pulmonary vessels to act as arteriovenous shunts.

Thus, in this man as in all other patients, cyanosis suggests one of the situations implied in the three previously mentioned questions. On the one hand, the patient may have a disorder which causes blueness in the presence of a normal arterial saturation, while on the other he may have arterial unsaturation due either to alveoli which do not function properly, or to vessels which carry venous blood around his lungs.

Frontiers

In closing, it is appropriate to mention a few frontiers of the problem of cyanosis. First, we do not have sensitive methods for resolving

venous admixture into its various components. Second, the possibility that latent arteriovenous shunts exist in the normal pulmonary circulation is still debated. Third, several diseases are particularly perplexing; among them are cirrhosis, anemia, pulmonary emboli and polycythemia vera, all of which are either known or thought to produce arterial unsaturation, and none of which is fully understood. In fact, the frontiers of the problem of cyanosis are approximately the same as those of cardiac and pulmonary diseases. Thus, these frontiers are numerous, broad, and complex.

ACKNOWLEDGEMENT

I am indebted to the members of the Third (New York University) Medical Service of Bellevue Hospital for their kindness in allowing me to discuss this patient. I owe especial gratitude to Dr. Ludwig Eichna, Dr. Bertha Rader, Dr. Marvin Kuschner, and Dr. Hugh Carroll. Also, Dr. Anne Davis is publishing a full description of the patient. She generously consented to let me review some of the features of his illness in this report.

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A VIRUS ASSOCIATED WITH TRANSPLANTABLE HUMAN TUMORS*

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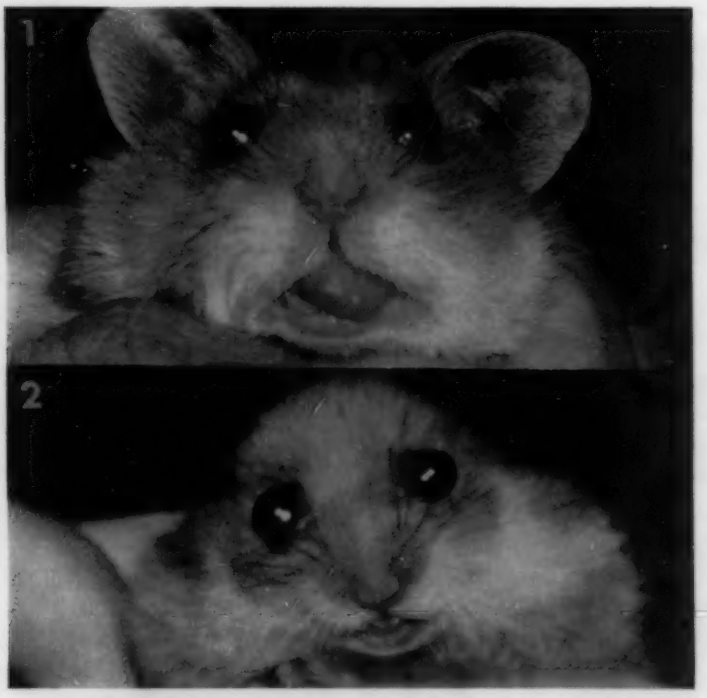
APPROXIMATELY two years ago, we were engaged in a series of experiments wherein fractions of transplantable human tumor cells, prepared by ultracentrifugation or sucrose gradient techniques, were used for the immunization of rats, mice, and hamsters of various ages. None of the rats and mice, whether newborn or older, ever developed abnormalities though more than 50 litters were injected with the fractions in each species. However, in this early series, among 100 litters of newborn hamsters comprising 932 babies that had received the fractions at birth, 81 mongoloid-type animals appeared.[1] The deformity was most specific and was characterized by small size, a flattened foreface or microcephalic domed head, protruding eyes and tongue, abnormal or absent teeth and bone fragility (Figures 1 and 2). It was in no way similar to the "runting" often described in rats or mice. Of these first 81 mongoloid hamsters, 41 were males and 40 females, an even distribution according to sex, that has continued. The single injection, given to the hamsters immediately after birth, was less than .03 ml. It was usually given subcutaneously but could be injected intraperitoneally with similar results. These early materials were prepared in 0.25 M or 0.88 M sucrose. Later preparations have also been made in normal saline, Ringer's solution, or distilled water. The type suspending medium does not appear to be of moment. None of these solutions used alone as controls have produced abnormalities. This, of course, is important *per se* but it is also of significance as regards the technique of handling and isolation employed, i.e., that infection did not occur from other sources than the injections. It was noted that the abnormality could be produced occasionally as late as 48 hours after birth. Later, when a higher titer of the effective agent was obtained, deformities were produced with injections

* Presented at the Combined Meeting of the Sections on Microbiology and Surgery and the New York Pathological Society with the Stated Meeting of The New York Academy of Medicine, November 3, 1960.



Figures 1 and 2. "Mongoloid" adult hamsters, injected when newborn with a filtrate prepared from one of the transplantable human tumors. Both have flattened forefaces, prominent eyes and tongues. The head of the animal in Figure 2 is microcephalic.

made four days, and occasionally six days, after birth. Hamsters injected with such high titer material when less than four days of age, could transmit the disease to non-injected animals in the same litter. The deformity was also produced by injecting hamsters *in utero*, and here the most interesting finding was that the same abnormality resulted regardless of the period in the mother's gestation that the babies were injected. The hamster has a very short, 16-day gestation period, so that seven days prior to birth is about as early as one can make adequate injections. The embryos are then very small. Yet whatever stage they were in, the abnormality was the same with one exception; in several of the animals injected *in utero*, there were extra digits on the hind

feet. A considerable number of the mothers, whose babies were injected *in utero*, aborted or gave birth to dead young. When 30 pregnant mothers were injected intraperitoneally, with care that the babies they were carrying were not touched, only two so treated had abnormal babies and then only one per litter. These mothers usually remained in good health with no evidence of disease.

The first thought that came to mind when these animals were seen was that some endocrine imbalance had been created. Yet careful study of the endocrine organs, in particular the pituitary and thyroid glands, failed to reveal abnormalities. It was concluded at that time that the protruding eyes and tongue resulted from diminution of skull capacity and not from endocrine disturbance.

These first animals presented a problem in handling. Many were lost because they failed to get enough food. Either their bizarre teeth made the mother reject them or their absence of teeth made eating of solid food pellets difficult. Once this was appreciated and a regimen set up where teeth were cut once a week and a soft mush diet provided, the little animals thrived, developed good coats, and remained in good health for periods comparable to normal hamsters. Over 2,000 have now been maintained for a two-year period.

It was soon learned that fractions from all eight of the transplantable human tumors regularly carried in conditioned rats and/or hamsters in our laboratory, could produce the specific abnormality described. The effective agent derived from these tumors, which varied widely in their type, was filterable and very stable in cold, either as a filtrate at 4° C. or in the frozen state at −79° C. It was, however, destroyed by heat and ultraviolet irradiation. It could be neutralized by normal rat serum, even after this was heated at 56° C. for 1 hour, and to a lesser degree by sera from other animals, such as rabbits, mice, calves, horses, guinea pigs, and chickens. In contrast to the neutralizing effect of the animal sera mentioned, human and hamster sera were unique in that they offered no protection.

Our next concern was whether we had picked up a contaminant agent from the host animals. This problem was approached in two ways: First, normal tissues and tumors from hamsters, rats, and mice were repeatedly tested and passed in baby hamsters with negative results, with the possible exception of one animal injected with an extract of a spontaneous rat tumor.[1] Spontaneous and transplantable rat, mouse, and

hamster tumors were also grown in conditioned rats, and again filtered and tested in newborn hamsters. No abnormalities resulted. Second, normal tissues and tumors from cancer patients as well as livers and spleens of individuals dying from accident, congenital heart disease, or other heart conditions, as well as pneumonia, were tested. This presented some problems as very fresh autopsies are hard to come by, and tissues other than tumor can seldom be removed at operation. The tissues from 8 "normal" individuals yielded nothing, whereas fractions of the livers and spleens of three out of four cancer patients produced a few mongoloid hamsters. The tumors of these patients did not. Our studies on the fresh human tissues as well as animal tissues are being continued with the ever-present problem of contamination being kept in mind.

When Dr. Dalldorf entered the investigation, he made an extensive study of the pathology of the adversely affected baby hamsters, and it was his observation that the abnormality we had seen was actually the end result of an infection in which the agent preferentially attacked the bones and teeth of the newborn animals.[2] The destruction of tooth odontoblasts and the enamel organ in young hamsters is the pathology which gives us our toothless adults with their appealing features of permanent childhood. Long bones show similar pathology, graded in degree according to the severity of infection.

About this time, work on passage of cell-free filtrates made from the livers and spleens of infected baby hamsters was intensified. Such filtrates were passed into new groups of newborn animals and an immediate increase of titer was produced, especially if the filtrate was made about the 6th to 9th day of life. Whereas previously half to all of the animals in an injected litter became mongoloid, they now died at the 7th to 12th day after birth, and it was necessary to dilute the filtrate in order to obtain survivors and mongoloid adults. As an example, in one such series, 10 out of 10 newborn hamsters became abnormal when injected with a filtrate directly derived from the HEp 1 tumor, one-half of a litter odd when this filtrate was diluted (1:10), and none odd at 10^{-2} dilution. A first passage filtrate prepared from livers and spleens of the infected babies showed a rise in titer to 10^{-4}, the next passage to 10^{-6}, and the third produced mongoloid animals when diluted out to 10^{-8}.[3]

One of the most interesting observations concerned with this agent is that, unlike the polyoma virus, it does not produce tumors. Instead it induces a deformity unlike any reported for the hamster previously.

Whether there is any relation between the deformity seen in hamsters and human mongolism where an extra autosome has been recorded is unknown. It has not been possible to do a good chromosome study as yet on these Syrian-strain abnormal animals, and the Chinese hamster with its small number of large, well-studied chromosomes is no more susceptible to the agent than are rats or mice. It is rather difficult, however, to envision a change in chromosome configuration occurring *after* birth. In passing, it may be noteworthy to mention the high per cent of leukemia recorded among mongoloid children.

Electron microscope studies have been made with the collaboration of Dr. Satish Chandra on the tumors themselves, on infected tissues of baby hamsters, and on pellets prepared from centrifuging filtrates. They have revealed a preponderance of a small virus, unlike any known to us, that has a small nucleoid less than 125Å in diameter. These studies are in their preliminary stage and are being continued.

A large series of investigations on the biochemical nature of this agent are being done in collaboration with Drs. Marion and Ralph Barclay of the Sloan-Kettering Institute. It has been learned that DNA prepared from the transplantable human tumors as well as bones of infected babies is highly infective and can produce the typical "mongoloid" abnormality in hamsters. The titer rises very rapidly on passage. Purified RNA from the same source has no effect whatsoever.

Immunological studies with this virus are also in their early stages. It has been found that the progeny of mongoloid babies can be completely protected by their mothers which have a high titer of protective and specific antibody in their sera. Litters of such mothers are completely normal in appearance whether or not they have been injected at birth with the agent. The babies apparently have had only a temporary passive immunity, for they offer their own offspring no protection. On the other hand, normal female hamsters that have had one litter of infected babies may or may not develop antibodies and thus a second litter that is infected may or may not be protected. If, however, the mother has had a litter injected *in utero*, she usually reacts strongly to the agent and develops antibodies that protect subsequent litters. Such mothers have occasionally died with a hemorrhagic liver which, when filtered, proved infective. Studies on agglutination and possible differences between specific and nonspecific neutralizing antibodies are also in progress.

In sum, then, a filterable agent has been found with the properties of a DNA-virus that is associated with eight human tumors transplanted in conditioned rats. This virus produces an infection with an attendant pathology and deformity, if injected into newborn hamsters. It has also been found in the livers and spleens of cancer patients but not, to date, with one possible exception, in the tissues of rats, mice, hamsters, or the tissues of human beings dying of other causes.

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MEDICAL EDUCATION, MEDICAL PRACTICE, AND MEDICAL CARE*

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IN a Public Health Service publication entitled *Physicians for a Growing America* is contained the report of the Surgeon General's Consultant Group on Medical Education. It points out that three major phenomena over the past thirty years have contributed to an increasing need by the nation for physicians. They are: 1) growth in population and change in its age composition with a more than proportionate increase in the younger and older age groups, which need the most medical service; 2) increasing use of medical services arising from improved economic and educational status with consequent higher standards of living, urbanization, hospital and medical care insurance, advances in medical knowledge; 3) changing patterns of medical service as reflected in increased utilization of hospitals; increase of physicians in hospital service; increased numbers of physicians in teaching, research, public health, and industrial medicine; decrease of physicians in private practice; and growth of specialization.

These trends were examined in preparation for estimating the magnitude of need for physicians by 1975. In full recognition that the physician-population ratio is a very crude index of adequacy of supply, the group set as a maximum goal the maintenance of the current ratio through 1975. The present ratio for medical physicians only is 133 per 100,000 population. To maintain that ratio will require a total of 311,500 physicians in 1975.

The net gain in number of physicians in any year depends on the sum of the number graduating from U.S. medical schools and new licentiates graduated from foreign schools, less loss of physicians by death. The principal sources of supply are the United States medical schools. In 1959 the medical schools graduated 6,900 students. It is estimated that the number will soon reach 7,400 annually.

* Presented, in part, at the Stated Meeting of the Medical Society of the County of New York, March 27, 1961.

Graduates of foreign medical schools are a secondary source of supply. Seventeen per cent of 7,809 physicians who entered practice in 1958 received their medical education in countries other than the United States. Some were United States citizens who had gone to other countries for their medical education. Based on the experience of the past 10 years, it is conservatively estimated that the number of foreign graduates licensed for practice will level off at 750 per year.

To maintain the 1959 physician-population ratio of 133 will require 311,500 physicians in 1975, and a graduation rate of 10,360—about 3,000 more than at present.

The present production rate of 7,400 graduates will not be adequate to maintain the ratio. In fact, if in the next 15 years the number of annual graduates of United States medical schools does not increase above the present rate, the physician-population ratio in 1975 will fall substantially to about what it was 30 years ago.

In the last 30 years the number of graduates has risen fairly steadily through expansion of existing schools and development of new schools. If this expansion rate should continue until 1975, the annual output of graduates would become about 8,500—a number still almost 2,000 short of the goal.

It is evident that if the present physician-population ratio is to be maintained during the next 15 years, the present production rate, even an increasing rate that includes increments comparable to those recorded in the recent past, will not suffice.

It is concluded that to keep up with the expected population growth by maintaining the present physician-population ratio, it will be necessary to increase the enrollment of existing medical schools and establish a number of new schools, probably 20 or 24.

To attain a goal of 11,000 medical graduates a year by 1975 will require about 12,000 entering students in 1971. There is some question whether this quota will be satisfactorily met.

In the past six years increasing difficulty in filling first year classes with acceptable students has been reported. There is some indication that the quality of medical students is not as high as a few years ago.

There are four deterrents to seeking a medical education: 1) Competition from other professions with attractive and challenging opportunities; 2) the time required for the education and training of a physician, many years more than most other professions; 3) lack of oppor-

tunity; 4) the high cost which can be expected to grow higher.

In addition to the question of meeting the quota of medical students, the cost of construction and operation of a new medical school must also be considered. In the modern medical school an educational program, medical care, and research are interrelated. The medical school needs classrooms and laboratories, clinical teaching facilities, and space for research. A library and student living quarters are also desirable. These facilities may be grouped under the heading of teaching, teaching hospital, and research, although it is impossible to draw a sharp line between the facilities used for one purpose as against the other.

In recent years the cost of constructing a new basic science teaching plant, exclusive of hospital and research facilities, has averaged about eight million dollars, with a wide range of variation. Similarly, costs of building teaching hospitals vary widely. Recent figures are in the range from five million to 14 million dollars for a 300-500 bed hospital. Construction of a research center may cost about two million dollars. Thus, the cost of a medical school and associated teaching hospital may on the average reach 20-22 million dollars. This would be capital expenditure for construction of a medical school.

But funds for its operation and maintenance must also be taken into account. In 1958 the 85 medical schools in the United States spent an estimated total of 264 million dollars. Of this amount 176 million was for basic operations and the remaining 88 million for grant-supported research. Hence, the average annual budget for the basic operations for a medical school was two million dollars.

As for modernization and expansion of the physical facilities of existing medical schools, a recent survey estimated that 325 million dollars were needed for new construction and renovation of teaching facilities, not including hospitals and research facilities.

Establishment of a new medical school is not a rapid process. It is estimated that 10 years are required before the school becomes fully operative and productive.

Finally, it is somewhat paradoxical that the proposed solution to the prospective shortage in medical manpower contributes itself to aggravating that shortage. If 20-24 new medical schools are constructed, they must be fully staffed to perform their functions in teaching, medical care, and research. Most of the staff will be physicians.

These, then, are some of the data, comments, conclusions, and

recommendations contained in the Public Health Service report.

The report concentrates on one problem: the probable shortage of physicians in the future. This subject is examined in many aspects with presentation of much data and information. Its recommendation that more medical schools be constructed represents one solution. It should be emphasized that the recommendation is based on acceptance of the existing system of medical education and demonstrated trends.

Purpose of This Article

The present article is not an attempt to cast doubt on the data as evidence. It does not challenge the conclusion that more physicians will be needed in the future. It does not deny that one possible solution is more medical schools. Rather, it would raise other questions germane to the problem of shortage of physicians; it would examine pertinent parts of the educational system and the prevailing practice of medicine, some touched upon but unexplored, others unmentioned. Particularly would it scrutinize the trends and some of the problems and difficulties that may be linked with the shortage of physicians. These matters would be examined as principal points, not as subordinate considerations. In the process other evidence would be brought in. In short, matters which have a potent influence on medical manpower, and should therefore be considered in proposing a solution, will be taken up. A broader approach is especially desirable since construction of medical schools is so costly and time-consuming. Here are some of the questions that may properly be raised:

Is the numerical strength the only consideration?

Should there be specification of the kinds of physicians?

Are the trends in medical education and in the practice of medicine in a desirable direction in producing the kind of physician needed for optimum and efficient medical care?

Are there other related difficulties and problems which exist now?

Is construction of more medical schools the complete and only solution to the shortage of physicians?

What will be the effect of this step on the trends and on problems that now exist?

Will it solve or magnify them?

Is the system of medical education in need of even more scrutiny and study, not just limited to numerical output, before more schools are

constructed?

What kind of physician should be produced for optimum and efficient care of the nation's population?

In raising these questions it is not suggested that an either-or choice of alternatives is mandatory, that acceptance of one line of action automatically excludes others. Quite the contrary. It is evident that production of physicians for optimum and efficient medical care is a complex, not a simple procedure. Hence, it should be approached broadly in proposing recommendations to modify or amplify it. New medical schools may indeed be and doubtless are needed, but how many is one critical question. Other changes that would affect the adequacy of output of physicians in the future, the number of schools needed, and the kind of practicing physicians may also be necessary.

These questions are associated with both medical education and medical care. They are raised because there are trends and existing difficulties that are well-known and are part and parcel of the problem of medical manpower. Data on them are presented briefly in the Public Health Service report. But because of their consequences, the present trends deserve more searching consideration. They are:

On the one hand

1. There is an increase in the number of interns and residents in hospitals.
2. There is a demonstrated rise in the number of specialists and a decline in the number of general practitioners.

On the other hand

1. There is a shortage of interns in a proportion of the hospitals.
2. There is an anticipated shortage of high-grade applicants for matriculation in medical schools.

These lines of evidence lead directly to two topics, one in medical education, the other in medical practice. The first is the internship and residency training program, and the other is specialization in medical practice. Obviously, these two developments are interrelated and both have a profound influence on the need for medical manpower.

The Intern Training Program

Let us trace the steps which the medical student upon graduation takes toward and through the residency training program. Upon grad-

uation he takes an internship. By one definition the internship is the fifth year of medical education; it is usually the first year of hospital experience immediately following the successful completion of four years of study in an approved medical college.

Purpose. The current concept of the purpose and function of the internship is precisely described in the following account taken from an article entitled "Essentials of an Approved Internship", originally published in 1919 and reprinted many times since by the Council on Medical Education and Hospitals of the American Medical Association: "When the internship became a generally recognized part of the education of a physician some 40 years ago, it was designed to provide the graduate's initial contact with patients, including responsibility for their care. It no longer constitutes such initial contact nor is it any longer the final step in the formal education of most physicians. Rather, it is now only one of several graded steps toward the assumption of total responsibility for patient care. As such, it remains an essential part of the education of a physician, but should be redesigned to fulfill its present purpose. With this concept in mind, it is evident that the internship can be conducted only in those hospitals in which the educational benefits to the intern are considered of paramount importance with the service benefits to the hospital of secondary importance."

This conception of the purpose of the internship is reiterated in the same article: "All hospitals offering intern training programs should be subject to the following guiding principles: 1) While the internship combines two functions—an educational period in the training of young physicians and a position rendering medical care and service to patients in hospitals and assistance to the staffs of hospitals—its educational function is of primary and paramount importance and its service function is secondary and incidental; 2) the service function of the internship should not be permitted to subordinate the educational purpose of the internship."

Formerly, interns largely rendered service to a hospital and learned by doing, with little or no organized and systematized educational program. Today, to allow ample time for the educational program, the intern's service duties are restricted. In short, much of his time is preempted and preoccupied by the education program.

Naturally, medical graduates want to take their internship in hospitals approved for intern education by the Council on Medical Educa-

tion and Hospitals. To win this approval—which is conceived to confer considerable prestige—a hospital must meet and maintain a set of standards formulated by the Council.

In adopting the standards and program, and thus winning approval, it must subscribe or submit to the Council's tenet "that the internship can be conducted only in those hospitals in which the educational benefits to the intern are considered of paramount importance with the service benefits to the hospital of secondary importance".

There is no regulation which requires a hospital to justify its number of requested interns. Its self-determined complement is subject to one delayed control: "A hospital which for two successive years does not obtain one-fourth of its stated complement of interns may be disapproved for intern training." The risk of incurring this penalty is the only restraining influence on possible overbidding for interns.

Less than 15 per cent of the hospitals in this country are approved for intern education.

It is apparent that the hospital, in addition to its function of medical care, has more and more become an organized and elaborate teaching center, and that avowedly the educational function is primary and the service function is secondary and incidental. The hospital is caught in a squeeze play. It needs approval for prestige and to obtain interns. Therefore, it must provide and maintain a costly teaching program. Furthermore, because so much of the intern's time is preempted and preoccupied by educational activities, he has relatively less time for service to the hospital. Hence, either more interns must be obtained to do what fewer used to do, or other arrangements must be made. For example, in some hospitals the fourth-year clinical clerk does part of what the intern used to do—and pays for the privilege—; while the intern receives a fifth year of instruction at the expense of the hospital. All in all, as one of its consequences, the intern education program has created a greater demand for interns.

How well has this system worked? It is worthwhile to review the record and present status of the system of intern placement.

Data on Availability and Occupancy of Approved Internships. Only 21 per cent of the nation's 6,845 hospitals with 50 per cent of the total beds provide approved training programs. Of these 1,438 hospitals with approved training programs, 50 per cent offer internships and residencies; 40 per cent only residencies; and 10 per cent only internships.

Twelve per cent of the hospitals providing 21 per cent of total beds nationally offer training for interns.

In 1914 when the first list of approved hospitals was published by the Council, there were 2,767 internships available in 508 hospitals. Although there were 3,594 medical graduates, only 2,527 appointments were made. One third of the graduates did not seek hospital training.

But by 1926, there were 4,727 available internships and 3,962 medical graduates. For the first time the available internships exceeded the number of graduates and that situation has continued to prevail, the imbalance has become more and more pronounced all the while. In 1946 approximately 8,100 internships were available, but there were only 5,800 medical graduates.

Today, the number of approved intern positions is almost twice the number of students graduating each year from the country's medical schools. For the academic year 1959-60 there were 12,580 intern positions offered in 865 hospitals. Of this total of available internships, 10,253 or 82 per cent were filled on September 1, 1959. The National Intern Matching Program provided 6,500. The balance of 3,700 were filled by other means. Approximately 288 United States medical school graduates did not participate in the National Intern Matching Program, and 251 who did participate were unmatched. Both groups probably obtained internships. Second-year interns added an indeterminate number to the total of filled positions. But 25 per cent (2,545) of the intern positions were filled by foreign physicians. Eighteen per cent or 2,327 of the available internships were vacant. The vacancy rate for internships was up slightly, about 1 per cent.

According to the National Intern Matching Program, each year approximately 120 hospitals completely fill some 2,500 positions offered. At the other extreme, some 290 hospitals fill no positions.

In passing, it is worthwhile to speculate on the reason for this disparity. It raises the question: What enters into a graduate's decision in his choice of a hospital for internship? It is not within the present purview to explore this point thoroughly, but some obvious answers come readily to mind. Foremost among them, it is likely to be a hospital in which he believes that he has a chance of consideration on the basis of his academic record. But beyond such preliminary practicalities in weighing possibilities, it is reasonable to assume that the graduate places a premium on the prestige of a hospital. By and large at the present

time, the medical school-affiliated hospitals hold the prime position in prestige. He thinks also of the prestige of the chief of a service in which he hopes to take a residency. In short, it is believed that many medical graduates tend to seek internships in hospitals where they hope to obtain residency appointments.

The figures which have been cited are typical of the situation over the past decade. The important points are that 2,327 internships in approved hospitals were vacant, and that 2,545 filled positions were held by foreign physicians. It is worthwhile to ponder on the impressive extent to which foreign-trained physicians are filling the number of available internships, yet to contemplate what the loss of them would mean. For, the figures indicate the precarious position of the hospitals in their dependency on foreign physicians and the potentiality of an alarming situation over intern vacancies in hospitals. If foreign physicians as a source of interns had been completely cut off in 1959 for whatever reason, 43 per cent of the available internships would have been vacant. For the future, this supposition is neither idle speculation nor a remote contingency. At present this source is threatened by the outcome of the recent examinations. Looking ahead, it is anticipated that, at best, only a fraction of the present number of foreign physicians will be available to fill internships.

It is also especially to be noted that 5,407 hospitals with 800,672 beds have no approved training program. Their record in obtaining interns may be easily imagined. Particularly overwhelming is the thought of what would happen if all these hospitals presently unapproved for interns were to gain this recognition.

Even without this hypothetical development the shortage of interns is extremely serious. The Council on Medical Education and Hospitals in its publication "Essentials of an Approved Internship" admits its existence. It states: "One aspect of intern education which warrants consideration is the growing discrepancy between the number of internships offered in hospitals approved for intern training and the number of applicants available to fill them. While this disparity, *per se*, is of no great import, its effect on the stability of internship programs throughout the country is of serious consequence." However, not all approved hospitals would pass off the shortage as of no importance.

It is apparent that there is a shortage and that there is considerable inequality in distribution of available supply, resulting in haves and

have-nots. For a considerable number of approved hospitals the present situation is bleak; the prospects are little brighter. An attempt to staff all hospitals, including those unapproved, with interns is a rather sobering contemplation.

One conclusion may be sharply drawn. There are not enough graduates from American medical schools to fill all available internships in approved hospitals. It is ironical that many hospitals met the requirements for approval in order to obtain interns. The seriousness of this shortage of interns cannot be overestimated.

Proposed Remedial Measures. Some hospitals, acutely aware of the intern shortage and desirous of meeting it, have recommended reestablishment of a basic two-year internship similar to that in effect prior to 1943. As late as 1941, 22 per cent of the approved internship programs were from 12 to 24 months in duration. Resolutions aimed at reestablishing the two-year internship have been introduced repeatedly at the annual session of the House of Delegates of the American Medical Association. Some would make the first year rotating and the second year optional straight. With recognition that few graduates would want to serve a second year just as an intern and without credit for potential Board use, the plan carries the suggestion that such graduates be given the designation of assistant resident in the second year and Board credit. This proposal is motivated by a dual objective: 1) to provide more adequate training for physicians for entrance into practice; it is based on the belief that a one-year internship is not sufficient; 2) to provide enough interns for approved hospitals.

A new two-year program in family practice, which is essentially the plan just described, was approved by the House of Delegates of the A.M.A. in June 1959 and is now being established in carefully selected hospitals.

It is worth noting that the one solution for relieving intern shortage that has substantial backing and official recognition would add still more time to the preparation of the physician for practice, a consideration that is believed to be already adversely affecting recruitment to the medical profession. It would thus run counter to another goal, shortening the training period. Furthermore, it would be effective only to the extent that medical graduates are now entering practice after a one-year rotating internship. I have been unable to find published figures on the annual number and percentage of interns serving only a one-year

internship before entering practice. But the percentage of medical graduates in 1958 reportedly planning to enter general practice may furnish an approximation sufficiently close for the present purpose. It is 21 per cent. If it is assumed that all of them are now taking only a one-year internship before entering practice, the proposed plan would reenforce the intern personnel of the nation by only one fifth of the medical graduates. Finally, if a straight internship with credit were allowed for the second year it would encourage accentuation of the already heavy trend to full residency, Board qualification, and more specialists.

Another obvious solution to the intern shortage is increased production of physicians. Even if this step were possible, it may be questioned whether it is sound reasoning to favor production of more physicians in order to provide enough interns for all approved hospitals. This is scarcely a compelling argument.

Still another possible answer to the problem is more equitable distribution of the existing supply of interns. With no necessity of justifying the self-determined complement, some individual hospitals may be requesting more than their fair share, more than they really need. A combination of justification of need, quotas, and rationing might help to ease the overall shortage.

It may also be that medical schools can never keep up with the demand for interns, that they can never produce physicians in sufficient numbers to fill all internships. It is fair to ask why so many hospitals have already been approved for intern training and others are preparing to seek approval, when the number of available interns is patently insufficient to staff all of them. It is conceivable that if no fancied or inferred sense of inferiority were attached to lack of approval, hospitals might be content to try substitute measures for the intern's duties rather than to seek an empty and futile recognition through approval but obtain no interns. In conjunction with this step it may become necessary to be less cavalier and more receptive towards adequate substitute measures for performance of interns' duties in hospitals unsuccessful in attracting interns. Certainly many hospitals are operating without them. Feasible and satisfactory substitute measures merit intensive study.

In this problem of intern shortage there are three interests to be served: the hospital's; the intern's; and the patient's. It would seem reasonable to suppose that the last takes priority over the first two; indeed, the first two subserve the third.

The Residency Training Program

The residency is the next step in medical education after the internship. In the plan of training it leads to qualification in a specialty. Residencies in 21 branches of medicine have been approved by the Council; residency training is now offered in 28 specialties and subspecialties. These residencies provide advanced training in preparation for certification by a Board in each specialty and practice in it.

It will be recalled that the Council in describing the guiding principles of its intern training program inferentially weighed the relative considerations of education, service to the hospital and medical care to the patient and flatly asserted the paramount position of education. In contrast, in its pronouncement on the residency training program, it takes a more moderate and harmonizing attitude on the issue. It states: "While the educational program is supplementary to the primary purpose of the hospital, i.e., the care and management of patients, it is directly related to this function in that it serves to improve the quality of medical care offered."

With the exception of a few specialties, a fully organized, comprehensive residency training program extends over three or four years. Actually the duration of the program varies to a considerable extent since it is influenced both by the requirements of the various specialty boards and the system of organization in the residency staff of the hospital. For example, an approved residency in anesthesiology requires a minimum of two years after internship for Board qualification; whereas surgery specifies a minimum of four years. Some hospitals have a pyramidal system of organization of the resident staff. For example, on the surgical service there may be one chief resident with 12 or 15 assistant residents in various stages of training, first, second, or third-year assistant residents. This situation creates a bottleneck. It is obvious that three or four or even more third-year assistant residents are in training for one position, the chief residency. In consequence, there are more eligible candidates for a chief residency than there are openings. Few hospitals experience difficulty in filling this position.

At this point one criticism of the system of residency training should be set forth. The system necessitates an early and irrevocable choice on the part of the medical student at a time when he may not have sufficient experience and familiarity with the matter that he is deciding. He

is constrained to commit himself to preparation for and to embarking upon training for a specialty with a serious penalty in time for later abandonment of it. Change to a different specialty means starting anew.

Published figures on the percentages of drop-outs and occupants of limited, incomplete residencies are not available. But it is possible to calculate indirectly an approximation. About 4,000 residents are certified by the Boards each year. If it is assumed that there were no drop-outs and incompletions and that the residency period extended over four years, there would be 16,000 residents in training. Actually, 26,000 residencies are filled. Therefore, there is a loss of 10,000 residents in the process of training. Since 25 per cent of the residents are foreign-trained physicians, they probably represent about 65 per cent of the incompletion. But that still leaves 35 per cent (3,500 to 4,000) of the drop-outs and occupants of incomplete residencies who are American-educated physicians.

Requirements for Approval of Hospital. In conducting or applying for approved residency programs, hospitals must meet requirements laid down by the Council on Medical Education and Hospitals of the A.M.A. Qualifications and organization of the staff of physicians in the hospital are specified, including members of the attending staff. Although the Council's requirements pertaining to the staff for a residency program specifically state "well qualified, experienced and proficient physicians, whether or not they hold membership in special societies and colleges or are certified in their specialty", its investigators make a point of recording the number of diplomates on the staff of each hospital seeking or holding approval.

Data on Availability and Occupancy of Approved Residencies. Nineteen per cent of the nation's hospitals with 47 per cent of total beds are approved for residency training. Slightly more than half of these hospitals offer both internships and residencies; slightly less than half, only residencies.

Between 1941 and 1947 the number of available approved residency positions increased almost threefold. By 1952 they were more than fourfold; by 1955, more than fivefold; and by 1958, more than sixfold. Thus in nineteen years the total residencies offered had increased from 5,256 to 31,733.

The vacancy rate was only 6 per cent in 1949; but it rose to 25 per cent in 1950. Then it gradually dropped to 18 per cent by 1957.

During the academic year 1959-60 there were 31,036 physicians pursuing specialty training in hospitals. Available residency positions totaled 31,733, of which 13,302 (42 per cent) were first-year positions. Filled residency positions amounted to 27,531; of this number, 11,494 were first-year appointments. There were 4,087 vacancies among residency openings. As with internships, only about half of all approved first-year residencies can be filled with American-educated graduates.

The overall occupancy rate for all residencies offered was 87 per cent, a gain of three per cent over the previous year. Of the 9,457 foreign students training in hospitals throughout the United States, 6,912 were reported as resident physicians. They constitute 25 per cent of all resident physicians.

Even though foreign physicians occupied 25 per cent of all filled residencies, there was a 13 per cent vacancy rate. Without the foreign physicians it would have been 38 per cent. On the whole, this record is somewhat better than that for interns, but it could scarcely be rated as satisfactory. Manifestly there is a shortage of residents as well as interns.

On the hospital falls the pressure to retain its approval for residency training. It faces the necessity of filling its quota year after year in a short market. Time, effort and money go into the planning and organization of a residency training program in order to improve the services of the hospital, to render better medical care, to merit community prestige, and to obtain residents.

But the residency system makes heavy demands on more than hospitals. For the residents it requires a long and expensive training period. This requirement contributes largely to the costly and time-consuming aspects of medical education which in turn are believed to be a deterrent to potential recruits to the medical profession. Also, it may be noted that the residency system undoubtedly adds to the cost of medical care.

But above all, it is the rapid growth of the residency training system, its trend and present magnitude that are foremost in importance in considering it for present purposes. It explains the increase in the number of physicians in hospitals and their lengthy stay. The residency system is the training ground which has furnished and is furnishing in ever-growing numbers the newly predominant type of practitioner—the specialist. And it must be acknowledged that it is producing a superior physician.

Specialization

So closely linked is the residency training program with specialism, as a production system is related to its product, that any further evaluation of the existing residency situation, its consequences and recommended changes, will now be viewed in conjunction with specialization.

Medicine is in the midst of a transition in its mode of production of specialists. Currently on the scene are three types of specialist, differentiated by their pathways to that status.

Traditionally and until recently physicians became specialists by the escalator system. After appointment to a service in a hospital, the physician gained experience and increasing responsibility in the course of duty, won promotion through successive posts, and finally received recognition as a *de facto* specialist. It was almost exclusively a system of on-the-job training.

The second type is the so-called self-styled specialist. Usually, he has a clinical appointment to a hospital. Since most hospitals are departmentalized according to specialties, to work in a department he must of necessity appear as a specialist in it. This status then extends to the outside. In the course of time he has himself listed in the American Medical Association Directory as a part-time or full-time specialist, depending on whether he limits his practice entirely or only partly to the specialty.

The third type of specialist is a Board diplomate. His certificate indicates that he has met the residency training requirements in an approved hospital and the examinations of a specialty board.

At present few specialists are being produced by the escalator system. It has been almost completely supplanted by the system of Board certification. The escalator system was not rescinded; it lost in competition with the Board system and was replaced by it. Apparently, hospitals which instituted residency training programs did not find it feasible to retain the escalator system. But many heads of services in hospitals approved for residency training programs reached their specialty status by the escalator route.

Its Growth. The phenomenal rapidity with which specialization has grown has already been set forth, but the topic merits elaboration. From 1931 to 1957, while practicing physicians were increasing at the rate of 16 per cent, the full-time specialists among them were increasing at the rate of 235 per cent. In 1931, only one private practitioner in six

considered himself a specialist; in 1940 the ratio was one in four. Today almost half of all physicians in private practice limit themselves to specialty practice.

Along with the increase in number of specialists, the number of certifiable specialists has also proliferated. In 1915 one Board was active; in 1924 a second was created. From 1930 to 1935 seven were added. Now examining and certifying Boards in 19 specialties, approved by the Council, are functioning. Three Boards certify candidates in subspecialties. Certification in the primary field is a requirement for certification in the subspecialties. Certificates in special divisions of their specialty are conferred by six Boards. Thus certificates may be obtained in 54 different specialties, subspecialties, or special divisions of specialties.

The number of licensed physicians certified each year by the Specialty Boards more than doubled in the seven years from 1942 to 1949, but it has since remained about stationary. In 1942 the Specialty Boards certified 1,756 physicians. The number rose slightly in the next year, but then declined in the succeeding two years. In 1947 the number began to increase, reaching 2,424. From 1949 to 1960 inclusive the average number of physicians certified each year was 4,145.

Since the rate of certification has been approximately constant over the past twelve years, while the rate of addition to the number of full-time specialists has continued to rise during that period, it may be speculated that this increase has come from physicians who had held residencies, had not sought or obtained certification, then later limited their practice to a specialty.

Over the past 25 years, while the number of specialists has been increasing by 235 per cent, general practitioners have been declining in numbers by 27 per cent. With the consequent change in proportions, the result has become an even ratio. In 1931 the ratio of general practitioners to full-time specialists was five to one; in 1957 it was about one to one.

If the present trend toward specialism and away from general practice continues unabated, ultimately the former will take over the remaining half and thereby all of medical practice.

It is not difficult to speculate on why physicians want to become specialists. Specialism carries premiums and privileges that give it luster. To name a few, not necessarily in ranking order: honor, prestige, higher professional status, superior professional ability, intellectual satisfaction,

and economic rewards. These are powerful inducements and attractions. Even the hospitals encourage, indeed exert pressure that contributes to the trend: there is no place for the general practitioner in the hospital. In short, the entire system of medical education, both directly and indirectly, is heavily weighted towards the acceptance of specialization. This strong current bears along with it the ever-mounting resident training enrollment. Specialism, the goal, is the stimulus to the production system.

Effects of Predominance of Specialists. If specialists come to outnumber greatly the general practitioners, this inversion is bound to have its consequences. One will be a change in the pattern of medical service; another will be accentuation of residency training. It is worthwhile to examine these potential effects in order to weigh the question whether it is medically necessary and in the national interest to encourage or even become resigned to the ever-increasing trend toward specialism accompanied by still further decline in general practice.

With predominance of specialization, the traditional and usual channel and sequence of medical care will no longer be available. With dwindling numbers of general practitioners the sick must perforce consult the specialist directly. Many are already by-passing general practitioners, either by choice or of necessity, to seek directly the services of the internist and pediatrician. Is this a desirable development that should be encouraged and expanded?

More than tradition upholds the function of the general practitioner; his role in the medical constellation has a sensible basis. There are degrees of illness; correspondingly, there are degrees of needed medical skill according to the nature and severity of the illness. Many, if not the large majority of illnesses, are not major and catastrophic with complex and abstruse diagnostic and therapeutic problems requiring the services of the specialist. Rather, they are the common and minor indispositions within the competence of the general practitioner for diagnosis and treatment. As for the lesser number of more serious and difficult illnesses that he encounters, the general practitioner is competent to make a tentative diagnosis and to refer the patient to an appropriate specialist. Thus the general practitioner is more than a diagnostician and therapist for these illnesses. He is a screener, router, and controller for any disease.

Abandonment of this system raises several questions: Is widespread general practice by a specialist a luxury rather than a necessity? For

ordinary illnesses, does the public need this costlier kind of medical service? Can the nation afford to allow the trend to continue? Is it a waste through misapplication of levels of medical expertness? Is it for this type of general medical practice that the specialist undergoes two to five years' training in residency?

As a second consequence of ever-growing specialization, medical education will be longer and costlier for a greater number of candidates. For, if the present trend continues, the residency training programs will have ever-larger enrollments. From the longer and costlier training period for more and more physicians will come in turn two effects: First, it may act as a deterrent to potential and able candidates to seek a career in medicine, thus contributing further to the declining reservoir of applicants. Secondly, it is almost certain to increase further the cost of both hospitalization and medical services. It is difficult to visualize how the increased cost of the educational period will not be passed on to the public. Today it is a common complaint that medical education is too long and too expensive, and that medical care is too costly. If the present trend to specialization continues and graduate medical training is ever more widely extended, it seems likely to have still further economic effects.

In view of the obvious problems accompanying the emerging changes in the practice of medicine, it is time to take cognizance of all the consequences, to take stock, and to ask pertinent and searching questions. Is unrestricted, predominant and widespread specialization desirable, medically necessary, feasible, economically sound, and in the national interest? Or is there an optimum ratio of general practitioners to specialists? If so, what is it? Should there be restrictions and controls, in short a ceiling, on the number of specialists to be trained?

Writing in 1947 on "Implications of Current Trends Towards Specialization", Victor Johnson, Secretary, Council on Medical Education and Hospitals, raised the same questions: "With over 10,000 physicians now in residencies, with increasing numbers of medical graduates seeking advanced training in the specialties, and with unprecedented numbers desiring certification by the American Boards, it is incumbent upon us to give serious thought to the question, 'How many specialists in the various fields do we need in this country?' . . .

"Adding the total number of certified specialists (approximately 26,000, excluding probably about 2,000 who have died), the additional

number of physicians who are not certified but limit their practice to a specialty (about 13,000) and a fraction (about one third) of the 35,000 physicians who give special but not exclusive attention to a specialty (equivalent to perhaps 12,000), we arrive at a total of about 51,000 specialists now at work in this country. If the estimated 52,800 required specialists . . . even remotely approximates the truth, it may be that our present specialist population approaches the optimum number for the best medical care. On the other hand, no one should be so rash as to conclude from these meager data that this is necessarily the case.

"Further thought and study are necessary concerning the number of specialists required in this country to provide the best medical care, as well as the number which the economy of the country can support. Whatever conclusions may be reached, there should be no attempt to limit arbitrarily the number of specialists entering or preparing for any field of medicine except as educational resources may continue to set limits, or as the plans of individual physicians may dictate."

That was written 14 years ago. The question is still with us. Surely there has not been undue haste to answer it.

The Issues

Thus far the discussion has remained on a concrete plane. But it is helpful to move to an abstract level because most of the difficulties in modern education and practice are really the dilemma of two issues:

1. Medical education vs. medical care.
2. Superiority and quality vs. numbers.

It may be argued that there is no conflict between the alternatives in each issue and that is true. But they are competing goals. If the resources are not sufficient for the attainment of both goals in each dilemma, one may receive priority.

At first glance there may seem to be no basis for rivalry between medical education and medical care. Which is really paramount, the education of the physician or medical care of the patient, may in the abstract seem to be a pointless question. Each is desirable and necessary. But in a concrete situation the question of priority and precedence emerges. In such a way it has arisen over interns.

Originally in their work in the hospitals, interns devoted their time almost exclusively to medical service. Their work came to be an essential part of the hospitals' medical care. But the Council on Medical

Education and Hospitals introduced a policy with its intern training program that ran counter to the practice of the intern's medical service to the hospital. His service was interrupted and displaced in part by the training program with its demands on his time.

It was shortly after the intern training program was introduced that medical education and medical care were thrust into the foreground as rival goals. The reason was shortage of interns. Medical schools were not producing enough graduates to fill the openings for interns in all approved hospitals. And this shortage has persisted year after year for 35 years. Along with the shortage was uneven distribution; for no control is exercised over the distribution of interns. The educational training system placed medical school-affiliated hospitals at an advantage. Hence, they have fared best in attracting interns; nonaffiliated hospitals have had much less or no success.

The Council is positive and insistent in its declaration that education of the intern takes precedence over his service to the hospital. Forty years ago it asserted "that the internship can be conducted only in those hospitals in which the educational benefits to the intern are considered of paramount importance with the service benefits to the hospital of secondary importance". That assertion, unmistakably clear, has been reprinted in every succeeding edition of the "Essentials of an Approved Internship".

That dictum does not coincide with the natural interests of the unaffiliated hospitals and probably the viewpoint of much of the public. For them it is not the primary purpose of a hospital to be an educational institution. And nothing comes ahead of medical service to the hospital patients. It is unlikely that hospitals seek interns in order to gain approval and prestige. Rather it is the reverse. Hospitals seek approval in order to obtain interns. Hospitals need the services such as interns can perform. If they did not, it would make little sense for the unaffiliated to adopt intern training programs, which is not their principal function.

There is no mistaking one of the consequences of the present system of training programs. It has existed for several decades; it becomes increasingly critical; it holds little promise of spontaneous self-alleviation. No warning could be more clearly, more sternly, and more ominously expressed than that in the most recent "Annual Report on Medical Education": "The nation will never produce enough physicians nor can it possibly import enough foreign physicians to support ap-

proved training programs for however many additional hospitals might desire them. In the period ahead, it is quite likely that the competition between hospitals for approved training programs will be decided largely on a basis of the quality of the training programs. The total number of hospitals and programs approved for training may actually decrease as a result of the consequent recruitment failure of the hospitals with the least attractive programs."

In theory, it would seem possible for hospitals to provide medical care without the services of interns and residents. But in practice an equally satisfactory substitute system has not been found. The Council's suggestion that house officer positions be established with adequate salary provisions has not been feasible; for obvious reasons there are few physicians interested in such employment. Several expedients now in use are makeshift and stop-gap; a permanent solution is not in sight. But surely the problem is not insoluble; nor have all possible remedial steps been tried.

In general, medical education and medical care have a mutuality. Education influences the quality, appropriateness and economy of medical care; logically the reverse influence should be the stronger. Medical care should be a principal determinant of medical education. In this relationship it should not be forgotten that education is a means, not an end. That concept might well be the guiding principle in efforts to restore balance and preserve mutuality.

A more pertinent question than paramountcy of either medical education or medical care would be how to accommodate to their mutuality. All in all, it seems most reasonable and practicable that the ultimate solution should come on the basis that the interests of both medical education and medical care should be served. To seek to achieve the most for each without adversity to the other would be the objective. It is scarcely a satisfactory situation for service and medical care to have a proportion of the hospitals ideally staffed with interns, but a still larger proportion with few or none.

Equally perplexing is the dilemma of quality versus quantity. In the education of medical students and physicians, if the goal is superiority for all with a long intensive period of training, it becomes difficult to satisfy the need for quantity.

Because of the superiority and high quality of modern physicians, it is almost presumptuous to raise questions about and examine the sys-

tem of education that produces them. Understandably, this very superiority engenders a reluctance to suggest any modification. Difficult as it is to amend a situation of inferiority, it may be even more of an undertaking to obtain alterations in a superior system.

Just as important as the plight of hospitals with shortage of interns is the predicted shortage of physicians for the future. It is estimated that not enough physicians will be produced unless new medical schools are established. To aggravate the situation, it is believed that there is a trend to decline in the number and quality of potential candidates.

Against this is to be considered the change in the pattern of medical education and medical practice. There has been an enormous increase in the number of physicians enrolled in residency training and in the proportion of specialists in practice.

Between the two situations a relationship may be postulated. The number of physicians impounded in residency training for several years is substantial. The lengthy period of medical education, extremely long if it includes residency training, and its consequent expensiveness is thought to deter prospective medical matriculants. Careers of equal prestige are open in other fields with shorter and less expensive preparation.

This situation brings out the issue of quality versus quantity. When so many physicians are becoming specialists and the number of physicians is expected to be insufficient to meet the medical needs of the nation, it is time to reexamine the question of quality versus quantity. It would appear to be sensible to review from time to time the criteria for the production of physicians but particularly so during a period of shortage.

The following principles might well be considered in an approach to finding means of overcoming the impending shortage:

1. Present standards in medical schools should not be lowered.
2. The use of medical talent should be neither extravagant nor wasteful. The proportions in which general practitioners and specialists should be produced should be in accord with the needs of medical care.

Observance of these principles would not lower the quality of medical care either individually or collectively. Rather, by stepping up production it would raise the level of overall medical care for the nation.

Each of the dilemmas presents rival and competing goals. But it is

not impossible that they may be reconciled with sufficient satisfaction to both.

Proposals and Recommendations

It is to be strongly underscored that the purpose of this article is not to be oppositional to the building of more medical schools, one program proposed to overcome the shortage of physicians. Nor is it to oppose or derogate from intern and residency training programs; nor is it against the practice of specialties.

Rather, it is to call attention to:

1. The vastness and complexity of medical education in all of its ramifications.

2. The interrelatedness of its parts; of the system and its product, the physician, and the practice of medicine.

3. Some problems and difficulties in the changing pattern of education and practice: the anticipated shortage of physicians in the future; the reduction in number and quality of the candidates; the shortage of interns and vacancies in resident positions; the surge in the production of specialists; and the concomitant decline in production of general practitioners. On these the article focuses.

4. The necessity for a number of actions directed towards solution of these problems. It is unlikely that a single action will bring complete solution by reversing trends or otherwise dispelling difficulties. For example, it is by no means certain, indeed it is highly problematic that construction of new medical schools will banish these problems. If the system of medical education is untouched and the trends continue, additional schools may magnify rather than diminish the situation. Even in considering multiple actions it is to be borne in mind that a single step capable of lessening one problem may aggravate another.

This article has presented nothing new in data and facts. Nor is it the first presentation of the difficulties and problems associated with medical education and the practice of medicine today. It is therefore not in the nature of a revelation. But for the most part, the difficulties and problems have previously been described and discussed singly and separately. Here they are brought together in the conviction that only a comprehensive approach can lead to an adequate solution.

The Cardinal Point. The cardinal point is that the entire system of medical education including graduate programs and medical practice

should be considered in breadth as well as depth before any step of major proportions is taken. To proceed on the basis of piecemeal thinking, of attempting to solve one problem detached from the others, of acting on a part without regard for the whole may be futile, or worse, if it compounds other existing difficulties. For example, it has been shown that much of the current trouble is associated with the graduate phase of medical education. Building more medical schools or changing their curricula may have little effect in resolving those difficulties. What is more, establishing a new school is costly, time-consuming and difficult. It is important to be sure of one's goals, before embarking on expensive, *ex parte* ventures.

The Principal Question. In both the system of medical education and the practice of medicine the principal question is: What kinds of physicians and what numbers, both absolute and relative, are needed in modern society on a national scale? From that deceptively simple question manifold points and subordinate questions arise. To answer it the needs for medical manpower must be more precisely defined. Because the existing gross physician-population ratio is not sufficiently refined either as a measure or as a standard, its value is limited. A somewhat more detailed set of measurements and criteria based on a thoroughly considered policy should be established. By these guides and means the needs in quantitative terms may be calculated. Goals could then be set with consideration both to the needs and to the realistic, reasonable chance of their fulfillment. Medical education could be designed and fitted for the attainment of these goals which would reflect the conception of what the pattern of medical practice should be. For, so closely linked is the educational system with its product that once the goals have been defined, the means to attain them may be more readily and effectively shaped. What is needed is a master plan covering production and use of medical manpower. It should reflect a definite policy of appropriate and economical utilization of medical talent with recognition of the imperative need to resolve the present accumulated difficulties.

Content and Scope of Proposed Deliberations

In a survey of medical education and practice with formulation of a master plan, a number of points would merit consideration. To give an idea of the scope, several are summarized in appropriate categories.

I. It is to be noted that the present trends in the changing patterns of medical education and practice, though they are an expression of lofty aims and have many commendable features, are not without their weaknesses, faults, and shortcomings. If these trends continue, they and their troublesome aspects may become progressively larger and more pronounced. It is time to count the consequences. Certainly it would be difficult to give unqualified and unconsidered approval to a system that would bring increased or even continued shortage of interns, further decline in general practice, and rapid efflorescence of specialism to the point of preemption.

II. It is fair to presume that the physician-population index in its present form as a measure is not sacrosanct. Certainly it is not sufficiently precise for purposes of planning. It denotes quantitative needs without regard to kinds. What is required is something more refined, namely, a set of ratios that will serve both functions by expressing the number of each kind.

III. To obtain these ratios it will be necessary to decide what kinds of doctors should be produced and in what proportions: how many clinicians, general practitioners, specialists, researchers, and administrators. It would seem to be a simple exercise in ascertaining what kinds are needed and in what numbers. But here the proposition is confused by the questions: Who should make the decision? What is the basis of it? It is not as irrelevant as it may seem at first glance to inquire whether the producer or the consumer group—medical organizations, medical educators, or the public—shall make the decision. Equally important is the basis of the decision on the kinds and proportions of doctors, whether need or desire shall be the criterion and whether appropriateness, economical production and use, national resources or size of the individual purse shall enter into the decision. In short, it raises the question which group shall have the final voice by either authority or economic control, and whether their decision will be reached with disregard for possible wastefulness of time, money, and educational facilities.

IV. If the present objective of well-trained physicians to practice medicine of high quality is to prevail, it may well be asked whether this is to be interpreted to mean more and more specialists, i.e., accentuation of the present trend. In evaluating this trend to an increased proportion of specialists it should be tested by the standards of whether

such a development is medically necessary, feasible, and economical in use of medical talent. To be quite concrete, should Board diplomates be serving as family physicians; is it an economical use of their talent and training? To put it more frankly, when expensively educated specialists engage in general practice to treat minor illnesses, is it not a wastage of training and an extravagance that the nation can ill afford? At some point it becomes desirable to calculate the optimum ratio that should prevail between specialists and general practitioners. At present it is one to one. If the trend continues the general practitioner will be in a minority. It may be readily asked whether the nation's medical services need as many specialists as general practitioners, to say nothing of specialists outnumbering them. In the search for an optimum ratio it is certain that both quantity and quality must be satisfied with consideration of the economical production and use of physicians.

In this task choices and decisions not easy to make will have to be made, and they will determine the future of the general practitioner and the specialist. Yet, whether developments are planned or unplanned, that is in natural course, choices will be made.

The future of the general practitioner, the specialist, and the residency training program may be conveniently considered together since they are interrelated and a decision on one influences the others. If it is decided that the decline in general practitioners should be reversed, it cannot be done without diminishing production of specialists unless total production is increased. If in the latter event the additional numbers of physicians produced do not predominantly become general practitioners, the outcome will swell the ranks of specialists more than of general practitioners and continue the current trend.

However, if it is decided that more general practitioners but relatively fewer specialists should be produced, this choice carries the possibility of relieving some of the present difficulties while meeting numerical needs. One method of attempting to raise the numbers and proportion of general practitioners would be inducement with incentives as powerful as, and preferably more powerful than those attracting to specialism. Oppositely, a decrease in the production of specialists might be brought about by removing incentives and by imposing limitations in numbers. As for the latter step, just which class of specialists, the self-styled or the Board-certified, should be held in check would then become a conspicuous question. We are in a transition period in which

the Board-certifying system is supplanting the old escalator procedure.

But before the procedure producing self-styled specialists is consigned to limbo and its departure hastened by non-recognition or outright bans, it is necessary to fit additional pieces into the puzzle. More and more people are using hospitals; more practice of medicine occurs there. And hospitals are operated on a specialty basis. If they maintain their present policy concerning staff, they will continue to need specialists, perhaps more. Then too, through the growing trend to group practice, a pattern is being set for increasing numbers of specialists to become more firmly imbedded in the medical system. Incidentally, this pattern is emerging as one replacement for the vanishing family physician. Thus, on the one hand more general practitioners are believed to be needed as family physicians; on the other hand, all the trends and the existing situation point to a need for more specialists. If the latter are to be Board certified, the production quota will have to be raised, that is to say, the number of physicians in residency programs will have to be increased with consequences in time, expense, and finally in recruitment of medical students.

Alternatively, the procedure producing self-styled specialists may have to be retained or hospitals modify their staff policy. Perhaps self-styled specialists, either in part or in whole, will remain a necessity.

Actually, a decision on the kinds and proportions of doctors needed may affect the numerical needs of medical manpower. For example, it is conceivable that modification of the general practitioner-specialist ratio may influence the total of physicians needed. Here is truly an area in need of deliberation and planning. Sooner or later choices and decisions will have to be made.

Once a decision has been reached on the kinds and proportions of physicians needed and ratios have been calculated, the medical education system producing the physicians could and should be examined in the light of the resulting figures. Then the system could be geared to meet the detailed estimated needs. Especially to be considered would be the methods by which specialists are produced, both self-styling and certification. In the event that fewer specialists and more general practitioners are found to be needed, it would seem to be a sensible step to determine whether the self-styling method of creating specialists should be perpetuated. By the same token, measures for quantitative restrictions on the residency training program might have

to be considered. From the ratio set, decisions will be reached which will determine whether the residency training program is to expand, contract, or remain stationary; whether more hospitals will be encouraged to seek approval or others now having approval but experiencing difficulty in applying the program will relinquish it. Surely hospitals that have residency training programs should not have an inordinate number of resident vacancies. In the interest of all parties, there should be a closer balance between positions and available residents.

If the trend continues of more and more physicians in residency training, the content and length of the program become important because of the dwindling roster of candidates for medical schools. It might not be amiss to review the length of some of the residency training programs to determine whether they could be shortened without detriment. It has also been suggested that inspection of the residency training programs in hospitals should not stop with examination of the prospectuses, plans, and syllabuses, but should include a check on their effectuation.

V. In calculating the magnitude and nature of the medical manpower needed for the United States, its distribution is not to be overlooked. Indeed, it is usually accepted that rural practice differs from urban practice. This factor would have to be taken into account. Also, the uneven geographical distribution of physicians by states and sections would be an important item in a master plan.

VI. Upon turning to the earliest phase of medical education, that in the medical school, it is to be noted that much has been written and spoken about the medical schools: cost of construction and maintenance, the length and content of their curricula, and their production rate of physicians. It will be recalled that a major recommendation in the Public Health Service report was construction of new medical schools, perhaps 20 to 24, to meet the needs of the future.

But is establishment of this many new medical schools, which are expensive and time-consuming to build and costly to maintain, the only solution to the estimated future needs of medical manpower? Furthermore, assuming that the present system of medical education is maintained, will the construction of this number of medical schools relieve or aggravate the existing plaguing difficulties? If the record of the effects of opening more schools in the recent past is any gauge, the prospects of resolving the persistent difficulties are not encouraging.

Indeed, is the production of more physicians, with nothing else changed, the complete answer to the present situation? Or could the estimate of the number of new medical schools needed be reduced and the desired results, including mitigation of existing problems, be achieved by additional and other measures?

First to be ascertained is what effect reexamination of the need for physicians on the basis of kinds and proportions, as well as the adoption of various other measures, will have on the estimated total need. If, in this revised approach, the estimated need is still in excess of the expected production rate, obviously ways and means to meet the numerical goal becomes a concern.

Even then, before considering new construction, it might be profitable to examine the possibility of increasing the output of existing schools without sacrificing quality. To the extent that the present schools can carry an increased student load, fewer new schools would be needed. Because of the economy in time and money this source for solution has an attractive practicality. Incidentally, in view of all the circumstances, it may well be questioned whether so many new schools, 20 to 24, would be likely to be constructed in time to meet the need. Certainly with increased output of existing schools the desired objective would be achieved more rapidly and less expensively than by new construction.

There are several ways by which increased output may be achieved: 1) shortening the curriculum; 2) more efficient use of existing facilities; 3) new and more effective teaching methods, and 4) expansion of existing facilities. Germane, therefore, to any deliberations on this subject of medical schools and their rate of production of physicians are such topics as: content and length of curriculum with a view to modifying and shortening it; exploration of new teaching technics; the efficiency of medical schools in organization and function; their capacity for expansion. All these points are to be considered with a view to ascertaining whether the schools could carry an increased enrollment.

Quite apart from the potentiality in numbers, the kinds of physicians produced is of equal importance. It is pertinent to consider whether there should be several types of medical schools for producing the several kinds of physician. A school might then aim to produce predominantly one kind: general practitioner, potential specialist, researcher, administrator, educator, or a physician equipped to proceed

in any direction. It is then important to decide whether different aims require different methods and curricula; whether schools should differ among themselves in their aims and methods.

The questions on aims and ways and means just discussed in relation to existing schools apply equally to new medical schools. For if the present system of medical education is to be maintained without survey, deliberation or alteration, it is appropriate to raise the question again whether construction of new medical schools will indeed relieve or actually aggravate the present situation with its problems and difficulties.

VII. Finally, for several reasons the internship training program looms large in any view to production of physicians. Because of the pronounced shortage of interns in many of the hospitals, it becomes imperative to evolve corrective and preventive measures. Standards for quotas and rationing might even be considered. Lengthening the intern period has been proposed. Just how long the internship should be to produce a well-trained physician is a key question for educators, hospitals, and interns. In all this the competing goals of medical education and medical care will have to be weighed.

Nor should the value of preceptorships be overlooked.

Conclusions

To effectuate the master plan and to reach the goals may require a combination of actions: more medical schools, changed curriculum, increased output of existing schools, more effective and accelerated teaching, modification of intern and residency training programs, rationing of interns and residents, and measures affecting the production of specialists, both self-styled and certified.

The problems and difficulties outlined in this report—shortage of interns, vacancies in residencies, decline of general practitioners, the upward surge of specialists, and the diminishing reservoir of candidates for medical schools—are not temporary phenomena. They have persisted for several decades and have steadily grown to such proportions as to constitute established trends. Their seriousness does not need to be detailed. Unless corrective measures are instituted they are likely to grow worse. It would seem that the time has arrived to review comprehensively medical education in all its aspects in order to remove existing difficulties and meet the needs of the future.

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TRADE ROUTES AND MEDICINE*

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THIS presentation on trade routes and medical education is intended to be both expository and polemical. It is, in other words, an historical exposition with a purpose. It aims not only to advance certain new ideas, but also to controvert certain old ideas on the development of medical knowledge and its diffusion by education.

The old ideas, those which have been crystallized during the past hundred years, and which are current today, are essentially of an evolutionist character. They incorporate and reflect the persuasions of the 19th Century evolutionist philosophers and sociologists, of Hegel, Herbert Spencer, August Comte, and Karl Marx.

These persuasions embrace two distinctive commitments; the one holds that all experience in time follows a distinctive and discernible pattern of progression. Hegel phrased it as a cyclical advance from thesis to antithesis to synthesis, and Spencer as an unending progression from the simple to the complex, and from the homogenous to the heterogenous.

The second commitment concerns the dynamics of historical or evolutionist progression whose impelling or driving force is conceived to be indwelling. There is, it is postulated, an inherent motivational force, and an intuitive directional prescience or discretion, which guides and directs the evolutionary progression. The evolutionary scheme is thus pictured as substantively and dynamically self-contained and presided over by a unique entelechy.

In the light of these persuasions, it is easy to understand why the evolutionist philosophers and sociologists inspired, and were partisans of, the *laissez-faire* school of thought, which, in a succinct sense, can be described as maintaining that "Nature knows best".

It should be noted that in a certain sense this was, and still is, a

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comforting "school of thought". It relieves the top dog from the need to search his soul, and helps to reconcile the underdog to his lower status. But though comforting, the thought is not competent to answer the gnawing question of the individual's role in the evolutionary scheme of things. Is he, the individual, to be a passive creature, lending himself to the portage of the evolutionary process, or is there some active role which is his to play, and if the latter, whence is he to draw the requisite guidance as to what he is to do, and *how* to do it.

This problem, incidentally, plagues the Marxist-Communist theoreticians. For they are primarily evolutionists, and firmly believe in the inevitable disintegration of the capitalist system and the triumph of communism. Marx forecast the pattern of this disintegration. The dilemma that confronts the Marxists amounts to this—if inevitable, why not wait for the inevitable to occur in inevitable time? Contrariwise, if the inevitable requires the intervention of man, then is it truly inevitable?

Marxists are expert in dialectic contortions, and they meet this paradox with a neat, though not ultimately definitive "solution," which can be phrased thus: The "inevitable" is inherent in, and derives from, the evolutionary pattern: Man is one of the implementing components of that pattern. It lies within the competence of man to perceive, in an anticipatory sense, the evolutionary pattern, and to align himself with it. He thus helps to create "the wave of progress" on whose crest he will, by reward, ride into the promised future.

Of course there is one catch, one "gimmick," in this neat solution, and that concerns the authenticity of the evolutionary process and of man's competence to perceive it in an anticipatory perspective. The catch, defined in epistomological and psychological terms, adds up to this: "Is there, in effect, an intrinsic evolutionary pattern to be perceived, or is the entirety of evolutionary schematization an imposition upon experience of man's propensity to organize perception into distinctive patterns?"

The issue is of enormous significance; for if it is true, as the philosophical and sociological evolutionists contend, that historical experience is determined by some inherent, transcending, determinate pattern, then man must indeed be an impotent creature, limited to the choice of either conforming to the scheme of things innate and thus surviving for a time, or of failing to do so, and suffering in dire consequence what our communist friends so euphemistically term "liquidation". On the

other hand, if the evolutionary pattern is taken to be no more than a convenient scheme for organizing data, like the decimal system in arithmetic, and hence, that there is nothing inevitable and compelling in the pattern; that the data of experience could be schematized otherwise, then man is concurrently emancipated to seek his human ends in human terms, and in human ways. Man is freed from bondage to the mythical scheme of Nature and its intentions, and at the same time is saddled with responsibilities for the discrete, intelligent, management of his human intentions within the realities of Nature.

The pertinence of the aforegoing lies in the fact that during the past hundred years the history of medicine has been schematized on an evolutionary pattern. Into medical-historical thinking there has entered the commitment of evolutionary predeterminism.

Fielding H. Garrison, in his preface to Osler's *The Evolution of Modern Medicine*, wrote: "The slow, painful character of the evolution of medicine from the fearsome, superstitious mental complex of primitive man, with his amulets, healing gods, and disease demons, to the ideal of a clear-eyed rationalism, is traced with faith and a serene sense of continuity."[1] Osler in turn quoted, as a motto to his book, a passage from the writings of Walter Moxon.[2] "A golden thread," wrote Moxon, "has run throughout the history of the world, consecutive and continuous, the work of the best men in successive ages. From point to point it still runs, and when near, you feel it as the clear and bright and searchingly irresistible light which Truth throws forth when great minds conceive it." In these two quotations we witness the profession of faith, and a serene sense of continuity in that golden thread of Truth that presumptively has run throughout history—still runs from point to point, and bids fair to continue running till time's end.

There is something charming and seductive in these passages, treating as they do of faith, serenity, and of effulgent Truth, made manifest in successive instalments. They are reminiscent of the sweet and gullible mood that prevailed in the late years of the 19th Century, and in our own, until the rude awakening of 1914. But it is precisely because of that rude awakening and of the even more disruptive and distressing socio-cultural experiences that followed in its wake, that we are *not* charmed for long, nor effectively seduced. We recognize the naiveté of the faith, the fragility of the serenity, and the tarnish on that golden thread of Truth that is said to run through time.

We are likely to be more responsive to the sober affirmation of the wise and learned Arturo Castiglioni who wrote, "He who follows the history of medical thought in its various branches will not find, as has been often and inaccurately stated, the continuous progress of a constantly ascending line. It is with strange interferences and marvelous spirals that this thought progresses from the demonism of the ancients to the suggestive healing of our times, from Biblical organ therapy to recent glandular doctrines, from the humoral pathology of Hippocrates to modern immunology."[3] "The changing succession of errors and victories," Castiglioni affirms, "constitute the very essence of our history, which leads us, by paths that are sometimes luminous and at other times barely discernible, to laws that today seem impregnable and yesterday were dogmas, to hypotheses that perhaps tomorrow will be truths."[4]

In this pungent passage Castiglioni juxtaposes, not errors with truths, but errors and victories. He clearly shies away from identifying effectiveness with truth. He is content to equate effectiveness to victory. The history of medicine thus neither mirrors a mystical Revelation of absolute Truth nor the evolutionary emergence of an indwelling potential of perfectibility.

Medical history lends itself to being chronicled, but not in such wise as to suggest that it is the log of an autonomy in momentum and direction. The authentic history of medicine is effectively an abstraction and refinement of given segments of experience drawn from the larger history of different peoples in different times and places. These segments relate in especial ways to the health of people, to the selection, training, and practices of their healers, to the beliefs and rationalizations concerning health and sickness shared in given times and places by the peoples and their healers.

Medical history thus understood has no primary existence of its own. It is derivative, like the history of Architecture or of Military Science, from the larger embracive history of Man. It carries within its own chronicles the witness of the determinants which shaped the larger destinies of mankind.

I have chosen to illustrate and to support this contention with an "exposition" on the relation of trade routes to medicine and to medical education. The term "exposition" is perhaps somewhat pretentious—"excursus" would be more appropriate, for the given limitations of the

Fig. 1. The Principal Centers of Ancient Civilization and of Medical Culture.

Fig. 2. Important Trading Ports and Market Centers In the Roman Empire.

occasion allow for no more than a general statement, and some specific instances by way of illustration.

It can be validly affirmed that medicine as a profession, the pursuit of the science of medicine, and medical education, are prone to prosper, as the people prosper, and most notably where they prosper most. Conversely, it is to be perceived in history that as a people, or as a locus declines in prosperity, so does the medicine of that place and that people.

Historically, human prosperity is related to trade and commerce. Both, trade and commerce, attest to the emergence of human existence above the subsistence level, and are in themselves an indication of a higher cultural development. It is not by happenstance then that, as one scans the trade routes of times past, that is, of antiquity and down the ages, one perceives that on land at given points, and by sea at given ports, trade routes stretch between the loci of great cities, in many of which there were developed important medical centers. In Greek antiquity it was Cnossos, Mycenae, Corinth, Megara, Athens, Samos, Cos, and Rhodes. Later it was Rome with far-flung outposts, spreading to all points of the compass—eastward beyond the Dardanelles and the Bosporus to the Black Sea, and westward to the Straits of Gibraltar, the encircling coast of Spain, and that of what we today call France. The lanes of commerce criss-crossed the Mediterranean, and reached even the farthermost points of the ancient world—"Kitai" or China, and the fabulous Indies.

Fascinating is the historic play of fortune that for the span of some time made some coastal cities preeminent and thereafter reduced them to nothingness, favoring others in their stead. This seeming pattern of Fortune's fickleness is in effect a tracery of the lines of conflict among the early historic peoples for the possession of land, colonies, and trade.

The rise of the *polis*, the city, favored the development of the crafts, and their produce was, in time, exchanged for that of other regions and cities. Thus it was that trade developed, mediated by seafarers, merchants, and markets. Thus, too, was the ground laid for wars in endless succession, even unto our own times.

It is not relevant to our concern to treat of these wars in any detail, but it is pertinent to note that as trade prospered, market-cities grew in population and wealth, and formed the nodal points of cultural development. It is also pertinent to observe that when the fortunes of war

shifted, the fortunes of cities were also likely to change, so that what was for a time a prosperous center of commerce and culture, could in a short time become a wasteland. More proximate still is the recognition that some, among the cities that once prospered and then declined, were, in their heyday, significant and in some instances pre-eminent medical centers.

The unique destinies of the individual market cities must not, however, divert us from the larger view of the shifting itineraries of trade routes, and the consequent emergence of new city centers that prospered in trade, and grew in cultural dimensions.

There is some convenience in speaking of the city center that stood forth, historically, in commerce or culture. The identification of, say, Epidaurus, Cos, Athens, or Alexandria, is easy. But in each instance the city refers to a people, and to that people's distinctive cultural orientation. Hence it is to be appreciated that the rise and fall of city centers, and the coincident shift in trade routes, favored the emergence of new cultural components, and these in turn affected and altered both commerce and culture.

These changes were primarily geographical in character, but it needs to be reaffirmed they were also cultural in nature. The new city centers, quite like the preceding ones, fostered cultural developments, but somewhat discontinuously, that is, in the bias and with the imprint of their own cultural orientations.

Since medicine is a component of culture, it perforce was historically affected by the shifting accents of the different cultural orientations of the different city centers in which it was cultivated. The history of medicine thus reflects the discontinuity that characterizes the embracive history of human experience and of human culture.

In the argument propounded, trade and commerce have been conjoined with culture in general, and medicine in particular, in a manner so intimate as to suggest a "Siamese twins". It would be easy, though entirely erroneous, to draw from this the conclusion that what is here propounded is a theory of the economic determinism of medicine. The relation between trade, commerce, and culture (medicine included) is relational but not causative. It is man who develops production, commerce, and trade. It is man's manipulation of these processes that reflexly affects culture. The processes do not of themselves have any autonomous and overriding influences.

But it *is* the attestation of history that, coincident with the decline of production, trade and commerce, there is experienced a lag, and at times a regression in cultural development. Such, by way of illustration, was the effect upon the Roman realm of the Arabist conquests in the 7th Century. "From the 7th to the 11th Century Islam was incontestably the master of the Mediterranean," wrote Henry Pirenne. "Three fourths of the littoral of this sea, hitherto the common center of European Civilization, now belonged to Islam."[5] "In the second half of the 7th Century all trade ceased on the shores of the Western Mediterranean."[6]

"The most important fact, from the social point of view, of the period extending from the Mussulman invasions to the Carolingian epoch, was the rapid reduction, and in the end, the all but complete disappearance, of the urban population."[7]

From the 8th Century onwards, Europe existed for 300 years without any intercourse with the countries overseas. The inevitable consequence was an almost complete cessation of trade, and, apart from a few local industries, such as weaving of cloth, which still survived in Flanders, there was an almost total failure of industrial activity, and money no longer circulated.

The decline of the West had in effect commenced some centuries before the time of Mohammed, but his followers hastened its culmination. "The fall of the Roman Empire of the West", wrote Castiglioni,[8] "marks a period of arrest in the history of [Western] civilization. Rigidified in a system of formulas and dominated by mysticism, medicine was forced to exist in a state of scholastic dogmatism, in which it is difficult to find any animating ideas."

From this time until the time of the Renaissance, not Europe but the lands of the Caliphates sustained and furthered the cultures of antiquity, and contrary to the opinion commonly held, they advanced the art, the science, and the teaching of medicine.

But, be it also noted, that in this interim, the trade routes that once led Westward, now were *Eastward* bent. The Arabs were master merchants. "From India they imported sugar cane into Sicily and Africa, rice into Sicily and Spain . . . , and cotton into Sicily and Africa; they acclimatized in Asia the manufacture of silk, which they learned from the Chinese; and from the Chinese also they learned the use and manufacture of paper, without which the invention of printing would have

been valueless, or would not have been made; and from China they imported the magnetic compass."[9]

During this period the non-Islamic remnants of Europe, in contrast, suffered impoverishment and deprivation. Papyrus, so vital to commerce, communication, and culture, disappeared, and spices, too, for they came in the same vessels. The wine of Gaza could not be had, and oil was no longer imported from Africa. Parchment replaced papyrus, and wax candle, the oil lamp. The use of silk became almost unknown, and gold became a rarity.

The Arabs were also good sailors. They constructed the ports of Cairo, Tunis, and Kairouan, and these served as "the *étapes* of a commerce which circulated from the Straits of Gibraltar to the Indian Ocean, through the Egyptian ports, which were in communication with the Red Sea, and the Syrian ports, which gave access to the Caravan route to Baghdad and the Persian Gulf."[10]

In Christian Europe, as Castiglioni observed, medicine existed in a state of scholastic dogmatism, devoid of any animating ideas.

The great schools were now not in Athens, or Rome, but in Baghdad, Samarkand, Ispahan, and Damascus. In these academies pupils from all parts received their instruction, a little in all sciences, but especially in theology, philosophy, and medicine. In Spain, too, the Islamic influence was witnessed in the rise of splendid and flourishing schools in Cordova, Seville, Toledo, and Murcia.

"The Arabs," Castiglioni affirms, "inherited all the medical patrimony of the past and became the faithful guardians of ancient medicine. When they and their relations disappeared from the theatre of their great exploits, and the fall of the Arabian domination of Spain marked the end of this historic period, the traces that they left were so remarkable that they remain highly significant of the role that the Arabs played in the history of civilization and of medicine."[11]

The Arabs were for long the teachers of the European medical novitiates. The works of Avicenna were read, together with those of Galen, far into the 16th Century, and as Puschmann affirms, Rhazes, Ali-Abbas, Abulkasem, Avicenna, Averroes, Maimonides, Ibn El-Beithar, Oseibia, deserve to be counted among the great men in medicine.[12]

The Arabs, who overwhelmed the Christian West in the 7th Century, in the 10th Century sought to live beside it in peace. The capture of Taormina in 902 marked the last advance of Islam in the West. Islam

was now willing to enjoy, rather than eager to extend, its domain. But the Christian West was not of like mind. At first, sporadically in Spain, and later in larger, more aggressive and better organized offensives, the Mussulman was pushed back and ultimately expelled from Europe. Granada was Islam's last stronghold, and it was reconquered by the Catholic Princess in 1492.

The Christian West that was dismally overwhelmed in the 8th Century, and remained disorganized for close to 300 years thereafter, did in the meantime recover a measure of its organic unity. By the end of the 12th Century Europe had not only recovered from the social and economic disorganization which had made it an easy prey to Islamic aggression, but had, in fact, fashioned a new and superior socio-economic order—that of the merchant-adventurer.

Industry came into being, fostered by and fostering commerce. Beginning with the 11th Century there developed a new type of merchant city, extending beyond and about the older cities. These were enlarged communities, fortified by moats, thick walls, and ramparts. They were "the nouveau-bourg," or "faubourg", and those who dwelt in them came to be known as the "*bourgeois*".

Driven off the Mediterranean by the Mussulman, and isolated from the East in the 7th Century, Europe turned to the lands beyond the Rhine and the shores of the North Sea. Then when commerce was revived in the 11th Century, it was, perforce, carried on, not as formerly by sea, but almost entirely over land routes. In the past the great merchant cities were almost all seaports. Now many of them were literally landlocked.

Now the highways and caravan routes were travelled by merchant adventurers, banded together into trade groups, known as Hanses. Initially, these groups of merchant adventurers were loosely organized for mutual protection against highwaymen and robbers, and at times, too, for joint commercial enterprises, pooling their individual moneys for some common deal of large magnitude. Later, the Hanses became stable and powerful trade organizations, centered in given cities, and federated in leagues that embraced the greater part of Europe.

Commerce encouraged trade and productivity, and also—learning. Commerce makes literacy one of its basic requisites. It fosters the keeping of books, of records, and accounts. It entails correspondence, contracts, and, be it noted also, litigations, hence it is a "patron" of the law.

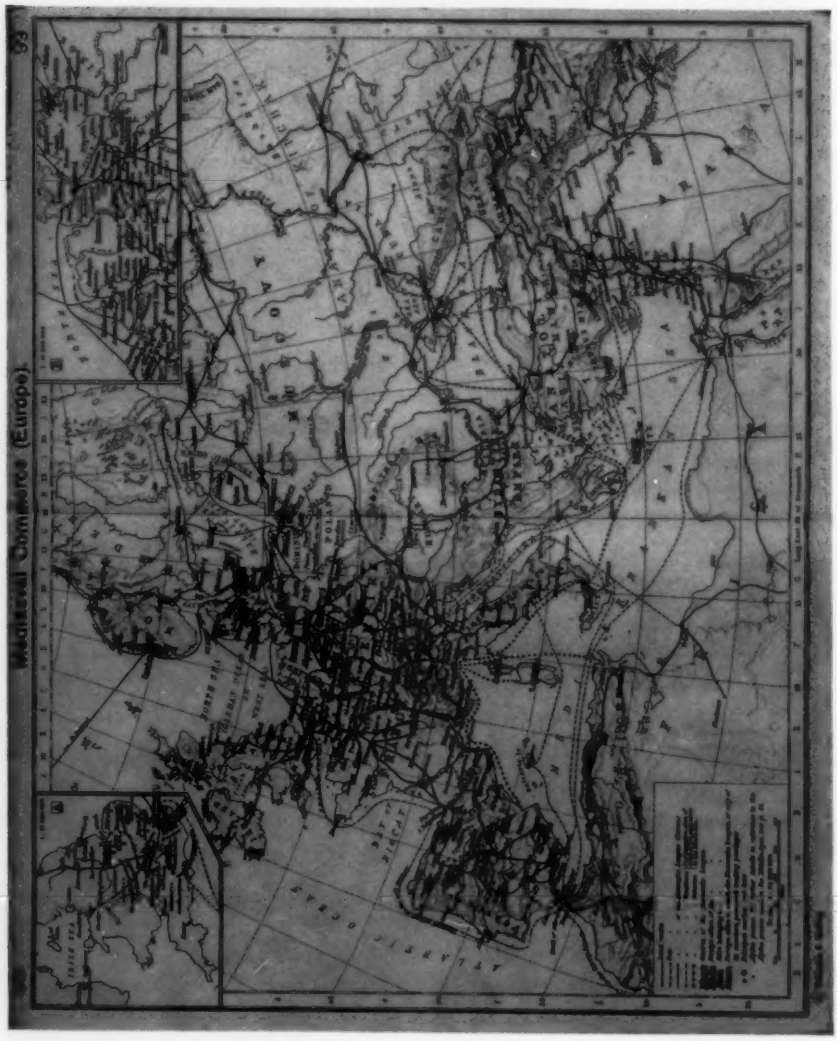

Fig. 3. Trade Routes in Europe, Developed and Extended after the Revival of Commerce in the 13th Century.

As for medicine its effects are multiplex.

Relevant to our interest is the fact that, scanning the trade routes, both maritime and overland, that developed in Europe following the revival of trade and commerce, we can perceive that they are dotted with what, in time, came to be major university cities. In a given number of these universities the study of medicine was cultivated preeminently.

The Italian cities, Bologna, Padua, Florence, Perugia, to name but a few, were among the earliest to establish universities. France and Spain were not tardy. Indeed, in terms of simple chronology, Paris predates Bologna, and Montpellier, Padua. Northern Italy, however, was the more advanced industrially and commercially. In the 13th Century, Siena and Florence were the banking centers of Europe, and remained such until the 15th Century. The Florentine weavers were world famous as artists and craftsmen even in the 13th Century.

Commercial activity was initially, that is, in the 13th and 14th Centuries, most intense in North Italy and South Europe, and then extended to the more distant regions, North, West and East. In a general way the vortex of commercial activity appears to have moved in time from the Southern regions of Europe Northward and West and East, and one can perceive a corresponding "transmigration" of academic intensity, from South to North, West and East. The 14th Century witnessed the foundation of universities in Prague, Cracow, Vienna, and Cologne. The universities of Ingolstadt, Basel, and Budapest, were founded in the 15th Century; Leyden, Edinburgh, Strasbourg, Göttingen, follow in sequence.

At this point I must underscore the fact that neither the extension of commerce nor the foundation of universities follows a neat pattern, and they are not *pari-passu*. Such a premise, I must emphasize, is no part of my argument. What is relevant to my exposition is the evident and vital relationship of commercial vitality to academic pursuits in general, and to the development of medical centers for service and education, at nodal points in the prospering regions. This is patent, historically, in that clearly those regions which once prospered economically, and then regressed, do not retain the academic preeminence they may have attained in the times of their prosperity. Again, regions that once were backward, on attaining prosperity are also likely to acquire competences in the realm of learning and science.

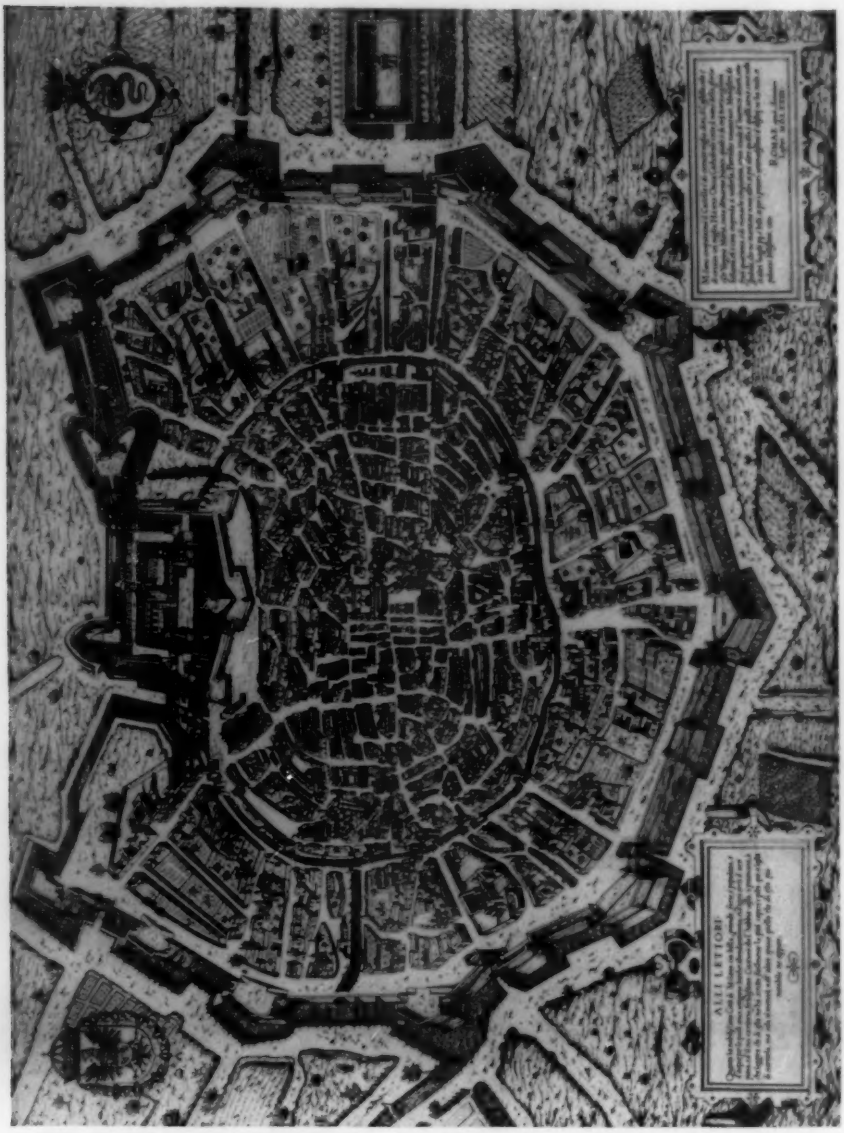

Fig. 4. MILAN, 1573. Typical Walled City of "Nouveau-Bourg". Notice the External Fortifications and the Outlying Sections that Surround the Inner Ancient City; the Castle Intrudes upon the Old City but Is Structured into the Newer Fortifications.

The histories of Egypt and Greece, of Byzantium, and the Islamic lands, attest to the first, and those of Germany, France, and Russia, to the second instance of the given historical generalization.

I have referred to this historical generalization as "patent". And so it appears to me. But it also embraces a recondite factor, one that is *not* patent, and one that is at the very vital core of my argument. In a sense this recondite factor is contrapuntal to my generalization, for it postulates that not all trade routes are "equal", that it is not of *little* consequence *what* seas or lands the routes traverse, nor *which* peoples ply the routes and pursue the trades. Furthermore, if these be matters of consequence, as I am sure they are, then what derives from them must likewise be different. Neither commerce, nor trade, are taken over in pristine form: nor with them their associated cultures. Each people in each geographic locus imprints its distinctive features upon whatever it takes over or develops.

Latin is the matrix of French, Italian, Spanish, and Portuguese, and yet how much they do differ, one language from the others. The medicine the Arabs learned from their Nestorian teachers they transmuted, and when they brought it back to the West by way of the Sicilian Isle, and Salerno, it was both less and more than they had learned. It was different!

I am sure that it must sound heretical, yet I would affirm that different also was the medicine of the Germanic peoples, the Gauls, the Franks, the Norsemen, the Slavs, the Iberians, not, I intend, in primitive or even prehistoric times, but rather in recent times, as these peoples have had the opportunity to cultivate medicine in their respective spheres of economic and cultural influence.

Thus medicine which seemingly has an historic continuity, is experientially discontinuous. So much of unity, consistency, or congruity, as we may perceive in its past, in its emergence, is of our own projection. The data of experience can be added in different ways to yield different summations.

But here it may be asked, granted that it be so, what profit is there in adding the data of historic experience in different ways to yield different summations? It must, however, be clear that the granting of this possibility is itself a great good deal. It renders historical study mobile and plastic rather than rigid and determinate. History is thus conceivable as the unrolling of adventure, rather than as the fulfilment

of predetermined ends. Furthermore, it emancipates and enfranchises the individual. Now he has an historic role to play, that is, he can determine rather than merely fulfill history. All of which has an intimate bearing on Medicine and Medical Education. As we have observed, the common belief is that medicine has "emerged" in an evolutionary and consistently progressive manner from the days of Hippocrates, the Father of Medicine, unto our own. Time and experience, it is affirmed, have sharpened the physician's perceptions and have extended and deepened his knowledge of the human organism, and of its operations in health and disease. Medical education has perforce experienced an equivalent development and has been similarly broadened, deepened, and refined. The history of medicine, and of medical education, thus viewed, cannot but be viewed enthusiastically as a triumphant march. And in this perspective it cannot but be anticipated that the "triumphant march" will continue–being carried forward by its own momentum and directed by its own insights which have grown ever brighter with the passing of the centuries. There is, accordingly, prevalent a sense of security and contentment, an optimistic anticipation of future good, inspired by this perception of the history of medicine.

But, as I have attempted to show, this historic perception is fictional. Neither medicine nor medical education have emerged in any consistently evolutionary progressive manner. Medicine and medical education are tied in with the changing destinies of peoples and places, so neatly mirrored in their trades, commerce, and trade routes. The destinies of peoples have been checkered, and so, too, has been the history of medicine and of medical education. But checkered history is history nonetheless, and even if lacking in consistency, it can bear witness to some orders of change that enhance those qualities of being which render human existence civilized and cultured. To insist that history is not consistent is not to totally deny the possibilities of change toward the humanly preferable.

But to deny that history is consistent and evolutionary in a deterministic pattern is also to regain some prerogatives of initiative for the individual man. If the history of medicine and of medical education reflect not a consistent progression but the vicarious play of blind fortune, then man, too, can enter the play of forces, and deliberately, that is thoughtfully, seek to mold the patterns of medicine and medical education to his own perceptions of what they can and need be.

It may, however, be asked, is not this precisely what is now being done in scores of institutions by numerous study and curriculum committees and commissions?

In a given sense, in terms of effort, yes! But the framework of these deliberations, their intellectual and historical orientation is usually not of the order I intend. They are, perhaps without even being aware of it, committed to the thesis of the evolutionary, consistently progressive development of medicine. In such a commitment the prerogatives of initiative are much constrained. Initiative and originality too easily become—Deviation!

This is too large a subject to argue in detail at the end of an already somewhat longish presentation. But I would submit that the current medical curriculum to a very large extent, and step by step, recapitulates in four years the past 400 years in the development of medical knowledge.

Perhaps if we undertook to add the data of historic experience in a different way, we might gain a different summation, one more pertinent to our current problems and needs.*

But that is not the note on which I want to end. I want rather to offer an "apologia" for my presentation and for this intention I shall borrow the words of Luis Diez del Corral, who in his superb work *The Rape of Europe*, affirms: "The depth of the future is proportionate to the depth of the awareness of the past." And he quotes Sartre, who wrote "History is not characterized by change, nor by the pure and simple action of the past: it is defined by the intentional resumption of the past by the present."

The historic time of Europe, in which we share, is divided into three Ages: the Ancients, the Mediaeval, and that Age, now terminal, which was born with the Renaissance. We are on the brink of a fourth Age! Our accustomed orientations do not and will not do; they suited the past—not the future. It is high time that we intentionally "resume" the past in the present; to review the data of the past in the perspectives of the present. This is what I have endeavored to do.

* Lest I be suspected of indulging in the fatuous satisfaction of "urging the other mouse to bell the cat", let me with due modesty refer to my own efforts to reassess the data of experience and gain a different summation: I intend my *The Meaning of Social Medicine*, Harvard University Press, Cambridge, Mass., 1954.

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ALEXANDER HODGDON STEVENS

1789-1869

The Academy's Fifth President

Dr. Stevens, a native New Yorker, graduated from Yale in 1807 and entered the study of medicine under his preceptor, Dr. Edward Miller. He took a course at the College of Physicians and Surgeons and then at the University of Pennsylvania, where he received his M.D. degree in 1811. The following year his trip to Europe was enlivened by his capture as a prisoner of war. He was detained briefly before being permitted to go on to London to sit at the feet of Abernethy and Astley Paston Cooper. A stay in Paris enabled him to become "Interne" in the service of Boyer at Le Charité and to become well acquainted with the great Larrey, Dupuytren, Lisfranc and Velpeau. Before he returned home he acquired knowledge of the new humane treatment of the mentally ill from Pinel and Esquirol.

Well equipped to carry on an extensive family practice, he also served as surgeon to The New York Hospital for 22 years, acquiring many honors in his profession. With Mott and Wood he signed the original notice calling for the establishment of the Academy, and was active in its early years, although by the time he was elected President he was 62 years old, and almost in retirement. His term of office was distinguished by two important occurrences, the incorporation of the Academy and the publication of its first transactions. The first event would not today be expected to incite opposition, but at that time there were cries of creating a monopoly. The second achievement met with more approval, and in the pages of the esteemed *Boston Medical and Surgical Journal* for 1851, we read: "Part I. of the first volume of the Transactions of this institution has been published by the Academy. We have rarely examined a series of medical and surgical papers with more satisfaction . . . the Academy is conferring peculiar favors upon the whole brotherhood of practitioners, when it sends forth a publication like this."

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The contents were varied. Most admired were the four surgical contributions of Valentine Mott. A sketch by Pliny Earle presented a history of the institutions for the insane in the United States, listing their physicians, 1817-1847. A timely article by J. T. Metcalfe discussed the "Purity and Use of Chloroform." There were also papers by Ashbel Smith of Texas, Gurdon Buck, and W. H. Van Buren, and an extremely important committee report "upon the comparative value of milk formed from the slop of distilleries, and other food." The Committee had been instructed "particularly to report the effect upon the human economy of milk taken from kine, tuberculously or otherwise diseased, from improper food, or confinement in these milk establishments." The Committee resolved that the Academy should inform the public authorities of the existence of this evil, to the end that they may take such action in the premises as in their wisdom they may think fit."

Dr. Stevens, renowned in his day, is little remembered, and in his obituary this was predicted: "The paucity of his writings . . . will contribute nothing to his posthumous influence. We apprehend that instead of being an abiding power, as was his right, posterity will suffer his name to become a mere tradition." The honor shown him by his contemporaries is indicated in the memorial address by John Glover Adams delivered at the Academy on May 25, 1871: "A Discourse, commemorative of the Life and Character of Alexander Hodgdon Stevens, M.D., LLD., late President of the N. Y. Academy of Medicine, ex-President of the College of Physicians & Surgeons. . . . President of the American Medical Association, President of the Medical Society of the State of New York, &c., &c., &c." These were impressive titles for one man to wear.

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Cornell University Medical College

May 16, 1961

HEMOLYTIC STATES

ALLYN B. LEY
Associate Professor of Clinical Medicine
Cornell University Medical College

May 23, 1961

HEMORRHAGIC STATES

MARJORIE B. ZUCKER
Associate Professor of Physiology
Sloan-Kettering Division
Cornell University Medical College

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Associate Professor of Pathology
College of Physicians and Surgeons
Columbia University

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1. Krantz, J. C., Jr., and Carr, C. J.: The Pharmacologic Principles of Medical Practice, Baltimore, The Williams & Wilkins Company, 1958, p. 843.

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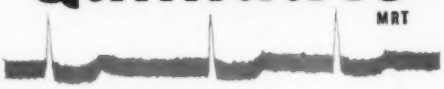

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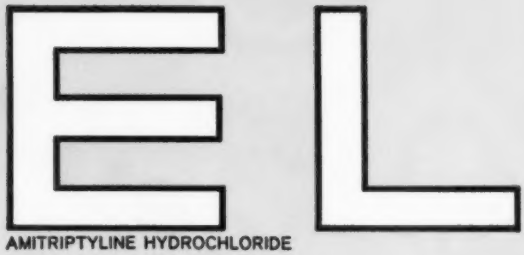

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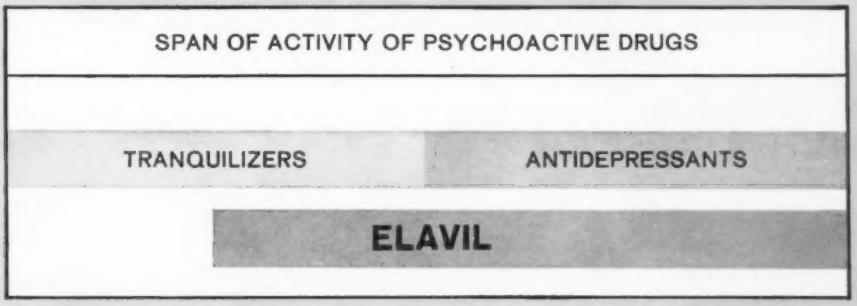

INDICATIONS: manic-depressive reaction – depressed phase; involutional melancholia; reactive depression; schizo-affective depressions; neurotic depressive reaction; and these target symptoms: anxiety; depressed mood; insomnia; psychomotor retardation; functional somatic complaints; loss of interest; feelings of guilt; anorexia. May be used whether the emotional difficulty is a manifestation of neurosis or psychosis, and in ambulatory or hospitalized patients.[3, 4, 5]

USUAL ADULT ORAL DOSAGE: Initial, 25 mg. three times a day, until a satisfactory response is noted. Many patients improve rapidly, although some depressed patients may require four to six weeks of therapy before obtaining maximum benefit. In severely depressed patients, as much as 150 mg. per day may be given. **Maintenance,** 25 mg. two to four times a day. Some patients may be maintained on 10 mg. four times a day. The natural course of depression is often many months in duration. Accordingly, it is appropriate to continue maintenance therapy for at least three months after the patient has achieved satisfactory improvement in order to lessen the possibility of relapse, which may occur if the patient's depressive cycle is not complete. In the event of relapse, therapy with ELAVIL may be reinstituted.

ELAVIL is not a monoamine oxidase (MAO) inhibitor. No evidence of drug-induced jaundice or agranulocytosis has been noted. Side effects (drowsiness, dizziness, nausea, excitement, hypotension, fine tremor, jitteriness, headache, heartburn, anorexia, increased perspiration, and skin rash), when they occur, are usually mild. However, as with all new therapeutic agents, careful observation of patients is recommended. As with other drugs possessing significant anticholinergic activity, ELAVIL is contraindicated in patients with glaucoma.

SUPPLY: Tablets, 10 mg. and 25 mg., in bottles of 100. **Injection** (intramuscular), 10 mg. per cc., 10-cc. vials.

REFERENCES: 1. Perloff, M. M., and Levick, L. J.: Clinical Med. 7:2237, Nov. 1960. 2. Freed, H.: Am. J. Psychiat. 117:455, Nov. 1960. 3. Dorfman, W.: Psychosomatics 1:153, May-June 1960. 4. Ayd, F. J., Jr.: Psychosomatics 1:320, Nov.-Dec. 1960. 5. Barsa, J. A., and Saunders, J. C.: Am. J. Psychiat. 117:739, Feb. 1961.

Before prescribing or administering ELAVIL, the physician should consult the detailed information on use accompanying the package or available on request.

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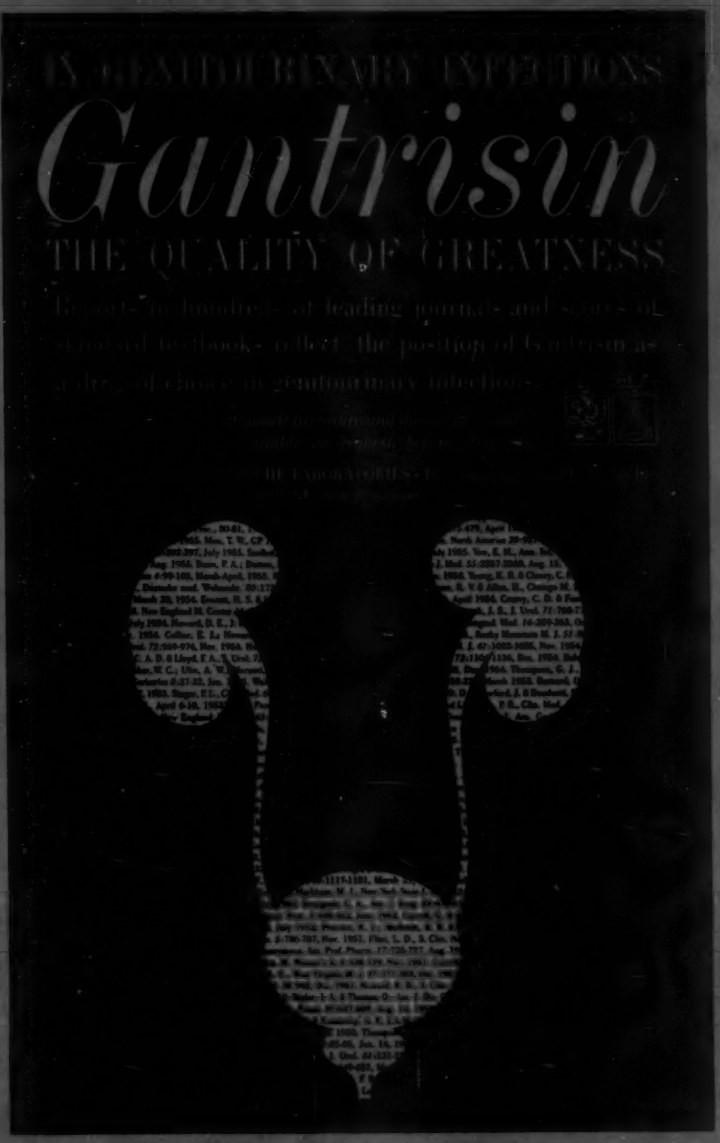
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